THE ENGINEER.

The British Industries Fair at Birmingham.

The British Industries Fair, Birmingham.

FOLLOWING our usual custom, we give in this Supplement some account of the exhibits which are to be shown in the engineering section of the British Industries Fair, which opens on Monday next, February 16th, at Castle Bromwich, near Birmingham. It is needless to relate that this present report is quite incomplete, and must be supplemented by others, but we should like to put it on record that manufacturers have been far more assiduous in helping us to describe their exhibits this year than ever before, and consequently our task is greatly lightened.

Some idea of the rate at which the Fair is growing in popularity and extent may be gathered from the fact that this year the area covered by the Exhibition buildings is 450,000 square feet, while it was only 150,000 square feet ten years ago. The area occupied by the exhibitors' stands has risen from 85,000 square feet to 215,000 square feet, and the number of exhibitors from 625 to 921. The area of the grounds has been extended from 7 to 45 acres, and there is consequently now ample parking space for visitors' cars.

The system of grouping the exhibits has this year, we believe, been carried out even more thoroughly than in the past, so that visitors wishing to investigate any one subject will be relieved of the necessity for searching about for the appropriate stands, while there are to be inquiry bureaux to give help to strangers. In fact, the Birmingham Chamber of Commerce has done everything possible in the circumstances for the convenience of those seriously interested in the exhibits.

COCHRAN AND CO., ANNAN, LTD.

It is gratifying to know that the vertical boiler lent to the Fair authorities by Cochran and Co., Annan, Ltd., of Annan, Scotland, will still be in the buildings as a working exhibit, for it has served a very useful part there in the past, and has ameliorated the wintry conditions in that part of the Fair most effectively, especially on the occasion of the show before last, when the thermometer went well below zero.

The Cochran boiler is so familiar to engineers that we need not describe its construction here, and it is sufficient to say that the one at the Fair is 7ft. in diameter by 15ft. high, and has 600 square feet of heating surface. It is intended for a working pressure of 100 lb. per square inch, is fitted with a Crosthwaite forced draught furnace, and has been lagged by Bells' United Asbestos Company. It will be used in supplying steam to a number of radiators in the Hardware Section of the Fair.

MOLER PRODUCTS, LTD.

Moler Products, Ltd., of 49, Moorgate, London, E.C. 2, will be exhibiting a range of Fos-al-sil heat insulating products, which are manufactured at Colchester from Moler earth imported from Denmark. This earth has the peculiar characteristic of carrying, naturally, just sufficient alumina to bind together the fossil silica when it is burned in the kiln. The examples shown will include insulating bricks, blocks and mortar, also insulating powder, and a special type of insulating aggregate from which a strong and highly efficient insulating concrete can be made, this latter being particularly suitable for the base insulation of heavy plant and also for furnace doors. On the company's stand, which is in the Gas Section, it is also proposed to have a small muffle furnace in operation. This furnace will be so constructed as to demonstrate the effect of insulation. One side of the furnace will be built of fire brick, the opposite side will be built of insulating slabs, the joints of which will be made with Fos-al-sil insulating mortar, whilst the ends of the furnace will be built of insulating bricks the joints of which will be made with ordinary mortar, and the door will be constructed of insulating concrete. By these arrangements a good indication of heat losses through the various types of walls will be obtained, and the company anticipates that specially interesting figures will be available in regard to the joints between the insulating materials.

FIG. 1—HIGH-RATIO LAMINATED GEARS

LAMINATED GEARS.

The principal exhibit on the stand of Laminated Gears, Sedgley-road, Owlerton-road, Sheffield, will be five pairs of staggered tooth gears mounted on a framework and driven by a 4 H.P. motor running at 1300 revolutions per minute. The final shaft runs at a speed of 1·363 revolutions per minute, so that the ratio of the gear is approximately 1,000 to 1, over the whole train of wheels. There will be another set in which a small motor, mounted on a wall bracket and running at 1630 revolutions per minute, will drive the shaft at 218 revolutions per minute with a single reduction, and the pair of gears which we illustrate in Fig. 1 will be shown, which, again, has a very high ratio.

These gear wheels are made of packs of steel plates having a tensile strength of from 50 to 55 tons per square inch hardened to a Brinell test of about 220. The teeth are cut in these plates in a generating machine, and the plates are then assembled on a sleeve, or spider, with the teeth of each alternate plate set half a pitch in advance of its neighbour, so that the staggered effect shown so plainly in the illustration is produced. Between the plates there is arranged a series of thin washers, which space the plates apart and, consequently, prevent the teeth of one plate from rubbing against those of the next plate in a sideways direction. Incidentally, this small amount of spacing accommodates the end play of the armature of an electric motor with variations in its loading. It is claimed for these gears that they provide double the extent of tooth contact between wheel and wheel that can be obtained with straight teeth, and that the use of rolled steel plates gives them better wearing qualities than other systems of construction. They certainly are quiet in operation and have practically no back-lash, while the cellular-like construction tends to retain any grease used for lubrication. Nearly all Laminated Gear drives may be lubricated satisfactorily with a suitable grease, and it is only in exceptional circumstances that an oil bath is essential. In many instances the gears may be run open, but it is generally advisable to fit a sheet metal gear case in halves, with a large inspection door near the point of mesh of the wheel and pinion; this case retains the grease and a sufficient quantity should be kept in it to ensure efficient lubrication. It also acts as a guard to comply with the Factory Regulations.

ALFRED HERBERT, LTD.

In accordance with the usual ruling of the M.T.M.A., Alfred Herbert, Ltd., of Coventry, may not show machine tools at the Fair, but the firm will have a display of small tools, chucks, &c., and two coal pulverisers. One of these machines will be opened out for inspection, while the other, of which we give an illustration in Fig. 2, will be shown in operation firing a typical forge furnace suitable for heating forgings up to about 12in. square. It is capable of pulverising 500 lb. of coal per hour.

The principle of the Atritor pulveriser has already been described in THE ENGINEER, so it is unnecessary to enlarge upon it here, but it is noteworthy that it should be coming into use in the metallurgical trades, in which it has already shown that it will effect considerable economies. In this connection the makers have supplied us with the following comparative notes as a typical example of what can be done by introducing pulverised coal firing to an "in and out" billet heating furnace for rolling purposes, scores of which are still in use in this country. By the introduction of a continuous billet heating furnace fired by pulverised coal, the fuel consumption when using cheap small coals will be from 1½ cwt. to 2 cwt. of coal per ton of steel, depending somewhat on the rate of working and the class of material being heated; say, 7 to 10 per cent. of the charge. The labour required will be only half that of the "in and out" furnaces, the regulation of the heat will be much

improved, and the labour of firing and cleaning will be eliminated. Such furnaces will show a marked economy over continuous furnaces fired by hand or using oil as fuel, and also over gas-fired regenerative reversing type furnaces. The following table gives a comparison based on data which have been compiled from actual operating conditions :—

	1	2	3	4
Type of furnace	"In and out"	Gas fired reversing	Continuous	Continuous
Method of firing and fuel used	Hand coal	Produce gas. Coal.	Oil	Pulverised coal
Cost of fuel used per ton..	18s.	18s.	70s.	12s.
Fuel used, cwt. per ton of steel heated	5 to 6	3 to 3½	1 to 1½	1½ to 2
Fuel cost per ton of steel heated, based on lower figures	4s. 6d.	2s. 8d.	3s. 6d.	11d.
Labour cost per ton of steel heated, based on equal output	1s. 5d.	11d.	7½d.	7½d.

Oil has a calorific value of 18,500 B.Th.U. per lb., as against average coal of 12,000 to 12,500 B.Th.U.

It will be noticed that the total working cost for the pulverised coal fired furnace is 1s. 6½d. per ton of steel heated, this being below 40 per cent. of the cost of its nearest competitor.

The cost of operating gas-fired furnaces is increased because of the labour required to fire the producers, and since the gas producer itself may have an efficiency

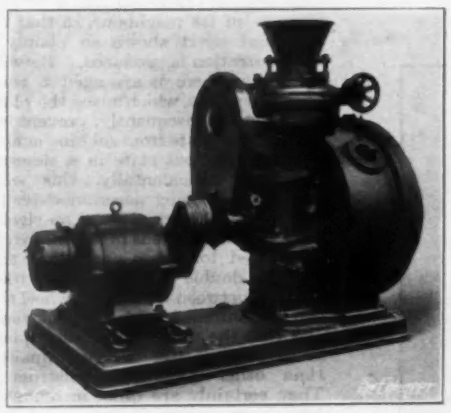


FIG. 2—SMALL COAL PULVERISER—HERBERT

of only 70 per cent., it is obvious that the results cannot compare with pulverised coal firing where almost 100 per cent. of the heat stored in the coal is actually liberated within the furnace.

W. CANNING AND CO., LTD.

The stand at the Fair of W. Canning and Co., Ltd., 133, Great Hampton-street, Birmingham, is generally made noteworthy by the display of electro-plating plant, especially that for depositing chromium, but this year there will also be a considerable proportion of buffing and polishing machinery on the stand. One of these polishing lathes is illustrated in Fig. 3.

This machine, it will be seen, is of the double-headed type, with the mops on well extended spindles, so that awkward-shaped jobs can be manipulated conveniently. The standard is shaped with a forward bend—the illustration shows the back of the machine—so as not to incommode the feet of the workmen. The motor for driving the spindle is in the bottom of the standard, and is connected by a multiple set of V belts, which give a silent drive without slip. The motor itself is mounted on a hinged plate, which can be raised or lowered by means of the adjusting screw seen in the engraving, to alter the tension in the belts. The motor starter is inside the standard, and is controlled by two push buttons on the front, one for "Start" and the other for "Stop." There is also a plunger on the top of the standard, which can be depressed to engage the spindle, and lock it securely when it is necessary to unscrew the nuts holding the mops in position. On the back of the machine there is a sheet metal cover, which can readily be removed to expose the motor, the starter, and the driving belts, while there is also a smaller inspection door on the front. The arrangement of the main bearings is such that the spindle can easily be withdrawn when one of the overhanging bearings has been taken down.

There will also be on this stand an example of an electric heater for warming up plating solutions and cleaning and swilling vats. It takes the form of a resistance coil covered with chemically pure lead, which is laid in the bottom of the bath. Arrangements are made so that one or two degrees of heating can be supplied with either A.C. or D.C. There will be a portable filter for purifying nickel solutions in those plants not provided with an integral filter, mounted on a truck so that it may be taken from vat to vat, an arrangement which should considerably improve the efficiency of some old-fashioned plating plants.

Among the other machines on this stand there will be a new polisher for hollow-ware, in which the chuck spindle can be set at various angles, with respect to the polishing spindle, so that a cross-grained polish can be produced. Automatic control gear is provided to enable one operator to attend to three or four machines. There will also be a vertical rod and tube polishing machine, in which the polishing abrasive is carried by an endless band, a knife polishing

FIG. 3—POLISHING LATHE—CANNING

machine of the wheel type, and some low-voltage dynamos for plating purposes, including one having an output of 5000 ampères with two commutators.

JOHN HANDS AND SONS, LTD.

John Hands and Sons, Ltd., of Cardigan Works, Belmont-row, Birmingham, will have a representative exhibit of power presses, which could be adapted for a great variety of uses. A power percussion screw press, developing a pressure of 80 tons, is to be shown in motion. In this machine the rise and fall of the ram is effected automatically by means of friction discs, as already described in these columns. The press strikes repeat blows of uniform intensity, but can quickly be changed over to make single strokes only. In the latter case it is necessary to depress the hand lever to obtain each blow from the machine. For general use, the press has to be operated in this way, since when it is used on repeat strokes for embossing, stamping, &c., if the operator should fail to place a blank in position in the dies, there would be a danger of damaging the dies unless they were specially designed to obviate such an occurrence. The press is under complete control, whether operating on continuous or single strokes, and the operator can

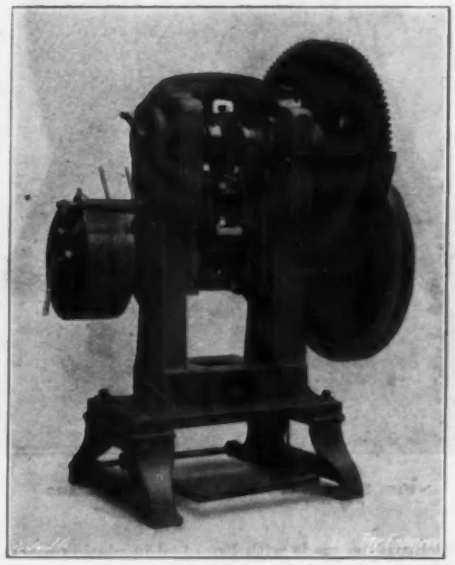


FIG. 4—100-TON PRESS—HANDS

stop it in any position on the down or up stroke. The firm's patented ejector, which is fitted to this press can be set for ejecting work from the bottom tool either by treadle lever or by power. In either case the ejector rod falls away as the slide rises, leaving the dies clear for the insertion of a new blank.

In addition, there will be on view standard presses for blanking, piercing, clipping, &c., upon each of which the maker's half-round key type clutch, which we have described in the past, is demonstrated. This clutch may be set for continuous running or single strokes, the change over from one to the other being effected practically instantaneously.

A heavy blanking press, representing a new range of machines recently produced, is illustrated by Fig. 4. This machine has a capacity of 100 tons, and its construction is fairly obvious from the engraving. Similar presses are made for capacities from 45 to 450 tons.

HOLLINGS AND GUEST, LTD.

There will be hydraulic presses of several different kinds on the stand of Hollings and Guest, Ltd., Thimble Mill-lane, Birmingham, and among them we have chosen that shown in Fig. 5 for illustration.

This press, it will be seen, is of the four-column type, and has three steel hot plates, so that it has two "daylights." It has been produced for the manufacture of artificial horn, safety glass, insulating materials, and such-like commodities. The working table of the press is of cast iron, 36in. by 30in., recessed for the ram and guided on the four columns. The press head is also of cast iron, machined on the underside to receive the hot plate. The three steel hot plates are 36in. by 30in. by 2in. thick. The distance or daylight between the hot plates is 6in. The ram is of cast iron, machined and polished and spigoted into the table and has a stroke of 12in. The steam supply is connected to the hot plates by flexible steam pipes. Of course, these presses can be made in various sizes and for various pressures to suit the work required to be done. As regards the method of operation, single presses can be worked by a hand pump or power pump, but a battery of presses is more conveniently worked by means of a low-pressure water

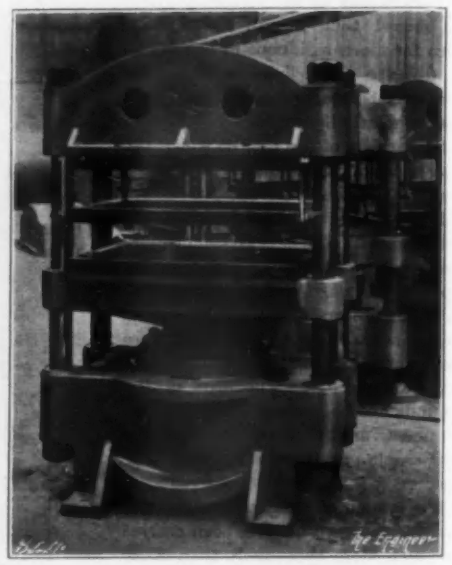


FIG. 5—THREE HOT PLATE PRESS—HOLLINGS

supply for closing the press, the final high pressure being applied by means of a hand pump.

There will also be on this stand a hydraulic hot plate press, suitable for Bakelite mouldings, of the vertical four-columns, two-daylight type, fitted with gas-heated platens. It is self-contained with a standard single-lever hand pump, the press and pump being mounted on channel framing. The press is capable of exerting a load of 50 tons when working at a pressure of 1 ton per square inch. It has a ram 8in. diameter by 6in. stroke, and hot plates 12in. square. The two daylights are of 4½in. each, with the head adjustable on the columns for a distance of 6in. A tilting moving table is also provided in order that the moulds can be withdrawn from the press.

The exhibits will also include some other hydraulic plant, such as a propeller starter and a scrap baling press, which are familiar to our readers.

G. D. PETERS AND CO., LTD.

All the latest models of Wilson plastic-arc welding equipments will be exhibited by G. D. Peters and Co., Ltd., of Windsor Works, Slough. The multiple operator set illustrated in Fig. 6, which will be shown in operation, is designed to supply welding current to three operators from a single motor generator set, through the Wilson automatic control panels to be seen in the background. Each operator can vary the current as required independently of the other others. The automatic control panels ensure that the current supplied to each operator does not vary more than 5 per cent., and this constant current, together with the steady voltage of the generator, gives a constant wattage or heat value in the arc, which is an essential condition for making the best welds. The level compounded generator is rated at 350 ampères at 37–45 volts, and is driven by a three-phase, 25 cycle, squirrel-cage motor, controlled by an oil-immersed starter. The speed of the set is 1450 revolutions per minute. A portable single-arc petrol engine driven plant, consisting of a Dorman four-cylinder engine, welding generator, and Wilson automatic control panel, is also to be shown. Another exhibit

will be a 100-ampère welder designed for use in garages and small engineering works, and, like the multiple operator set, this machine is to be shown in operation. Other exhibits will include the latest examples of welding accessories, such as welding screens, lenses, welders' gloves, electrodes and electrode holders, and wire brushes.

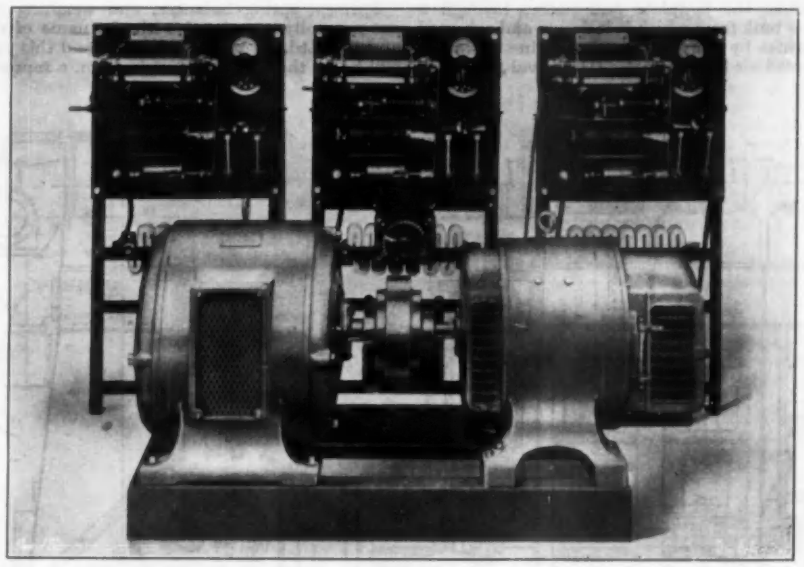


FIG. 6—MULTIPLE OPERATOR WELDING SET—PETERS

FOSTER INSTRUMENT COMPANY.

The main exhibits of the Foster Instrument Company, of Letchworth, will consist of instruments for measuring temperatures, ranging from the lowest to the highest obtainable, and for the automatic control of these temperatures. Perhaps the most original exhibit, however, will be the Foster Introscope for the examination of bottles for holding gases at very high

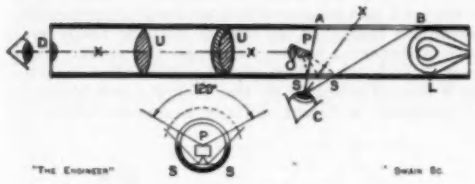


FIG. 7—INTROSCOPE—FOSTER

pressures. The complete apparatus comprises two introscopes with a carrying case and spares and accessories, as shown in Fig. 9. For radial examination the long introscope is used with a lamp fitting that throws a strong light on to the area under observation. Owing to the limited size of the aperture through which the instrument has to be inserted, the lamp fitting has a hinged portion—as shown in Fig. 8—so that whilst the fitting lies straight on insertion into the bottle, it assumes an angular position when it is inside.

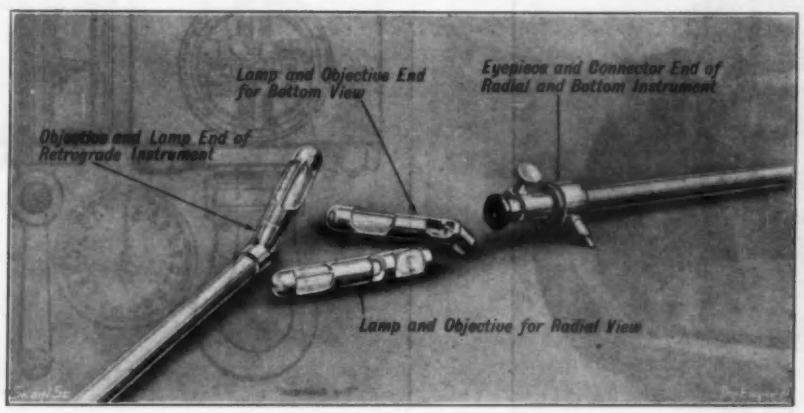

Lamp and Objective End for Bottom View
Eyepiece and Connector End of Radial and Bottom Instrument
Objective and Lamp End of Retrograde Instrument
Lamp and Objective for Radial View

FIG. 8—THE INTROSCOPE DISMANTLED—FOSTER

An interchangeable fitting is provided. By means of a prism it gives a downwards view parallel with the axis, whilst for examining return ends adjacent to the neck of the bottle a separate short introscope is used, as shown in Fig. 10. The effective magnification is between 3 and 5 to 1, and owing to the patented optical system the area seen in any one position of the lamp is large, and complete examination of the bottle can be made in a short time. The principle of operation will be better understood from Fig. 7, which shows longitudinal and transverse sections through the apparatus. The surface under examination is illuminated by the light from lamp L, which emerges from the aperture A B in the enclosing tube. An image of the illuminated surface is transmitted to the prism P by the auxiliary mirror S S, and by the prism to the wide-angle objective O. The image formed by the objective is transmitted to the eye-piece D by the system of reversing lenses U U, the number of which depends on the length of the introscope. The interior surface under examination appears as if viewed by the eye at C; in other words, the user is able to see the surface just as clearly as if it were laid out under his eye. The light from the lamp L enables the surface to be examined with great exactitude, any minute inequalities being thrown into "high relief," and there is no dazzling effect to the eye of the user. The angle of view in an axial direction is wide. Similarly, the angle of view is large in a circumferential direction. The whole circumference can be easily covered. The degree of magnification by the eye-piece can be adjusted within wide limits to suit particular cases. The normal instrument has a plain tubular exterior without projections. The only limit to the length of the apparatus is the permissible number of reversing lenses, so that there is no difficulty in examining very long tubes or deep enclosures. A camera may be adapted to work in connection with the introscope, so that photographs may be made to give a permanent record of interior defects, corrosion, and so forth.

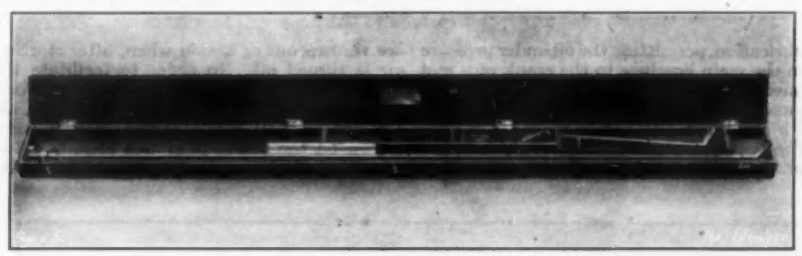


FIG. 9—INTROSCOPE IN CASE—FOSTER

PARKER, WINDER AND ACHURCH, LTD.

It seems that there will be a flavour of Canada about the stand of Parker, Winder and Achurch, Ltd., Broad-street, Birmingham, not on account of the origin of their exhibits, but rather through their possible application. They will take the form of three house heating boilers by Sugdens, the National Radiator Company, and the Beeston Boiler Company, all fired by means of the Parwinac oil burner, of which we give a sectional view in Fig. 11. Such installations are becoming quite common in Canada, and we have just had news of an installation which has run for several months without the least attention whatever, since a thermostat regulates the amount of oil being burned, so as to maintain a constant temperature.

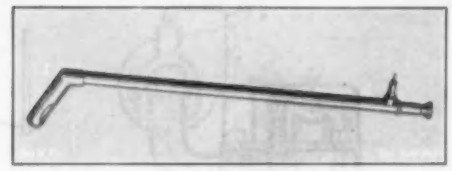


FIG.—10—SHORT INTROSCOPE—FOSTER

The essential feature of the Parwinac burner is the spinner cone. This cone is furnished with a little turbine wheel which rotates it at a high speed, owing to the passage of the air necessary for combustion. The fuel oil coming forward through the centre of the burner, is spread on the surface of this cone, and, on account of its conical form, is urged forward by centrifugal force, to be thrown off in a very finely atomised form. There is a screw adjustment on the oil outlet valve which gives a very fine regulation of the amount of fuel being burned, while the orifice has a loose bush or collet that can be changed to suit the length of flame required. A variety of controlling instruments will be exhibited for use in connection with these burners. They are designed for controlling the fuel supply according to the room temperature—within 1 deg.—for guarding against low water, high stack temperature, lack of ignition, and so forth. In fact, it would seem that once one of these installations has been "set away," it would go on indefinitely, provided that it was provided with fuel.

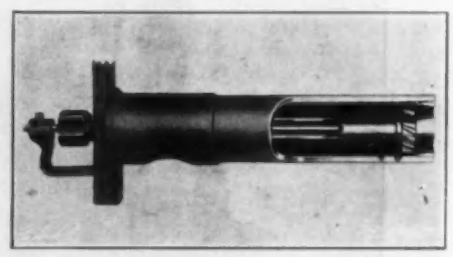


FIG. 11—OIL BURNER—PARWINAC

NATIONAL GAS ENGINE COMPANY, LTD.

An interesting exhibit which will be seen at the stand of the National Gas Engine Company, Ltd., of Ashton-under-Lyne, is the four-cylinder, four-stroke, vertical engine which we illustrate in Figs. 12 and 13. It is of the totally enclosed, cold-starting type, and, with a cylinder bore of 7½in. and a stroke of 11in., has a designed output of 100 B.H.P. at 600 r.p.m., the maximum output being 110 B.H.P. The same design has been applied to engines having outputs of 50 up to 150 horse-power, with two up to six cylinders. As our engravings indicate, both the bedplate and the column are one-piece castings, large inspection doors being provided which give access on either side of the column casting to the crank shaft bearings and the moving parts. The cylinder heads, which are deep in section, are arranged for water cooling, and the air and exhaust valves are made of a special steel,

and have renewable guides. The cylinder heads are so designed that they can be removed without having to dismantle either the air inlet or exhaust pipes. There is a separate fuel pump for each cylinder, and the cam shaft, which is driven by spur gearing from the crank shaft, runs in an oil bath. The water-cooling system is of the open type, and, as shown in Fig. 13, the outlets discharge into funnels arranged on the top of the water-cooled exhaust pipe, regulating cocks being fitted at the end of each outlet pipe.

A solid forged crank shaft is used. It is drilled for forced lubrication, permitting the oil under pressure to pass from the main bearings to the crank pins and up the connecting-rods to the gudgeon pins. The pistons are made of hard close-grained cast iron, and are finished by grinding. All piston rings are of deep section. The valves are operated by push-rods and the steel cams work in an enclosed oil bath. A feature of the spray valves is that the atomisation is effected by the combined pressure of the fuel and the special design of the valve. The spray valves pass through the cylinder head water jackets to the compression chamber, the whole of the surface of which is water cooled.

For varying the speed of the engine there is a hand control gear on the crank shaft governor, which enables the speed of the engine to be raised or lowered about 5 per cent. while the engine is running. The governor operators directly on the spill-valve of the fuel pump, by-passing the fuel earlier or later in the stroke as the load on the engine falls or increases. The forced lubrication system comprises a gear type pump driven from the crank shaft. The surplus oil is returned to the bedplate and passes through a strainer to a tank from which it is drawn and returned to the bearings by the pump. The engine is started on compressed air by automatic timing valves, which are thrown out of action when, after starting up the air is turned off. In order to facilitate the use of specially heavy fuel oils, an oil heater, worked from the heat of the exhaust gases, is supplied, also a fuel strainer and oil supply tank. Other engines also shown on the same stand will include a 16 B.H.P., 375 r.p.m., horizontal oil engine, and a 10 B.H.P. oil engine coupled to a 6½ kW generator with a "Texrope" drive. A small 2¼ to 2¾ horse-power petrol-paraffin engine driving a ram pump with a delivery of 1000 gallons per hour, against a maximum head of 150ft., will be shown, along with a similar engine coupled to a belt-driven air compressor having an output of 3½ cubic feet of free air per minute at a pressure of 275 lb. per square inch. The firm's gas engine department is to be represented by a small 3½ to 5½ horse-power engine, designed to work on town's gas and to run at speeds from 650 to 1000 r.p.m., with either tank or hopper cooling, as may be required.

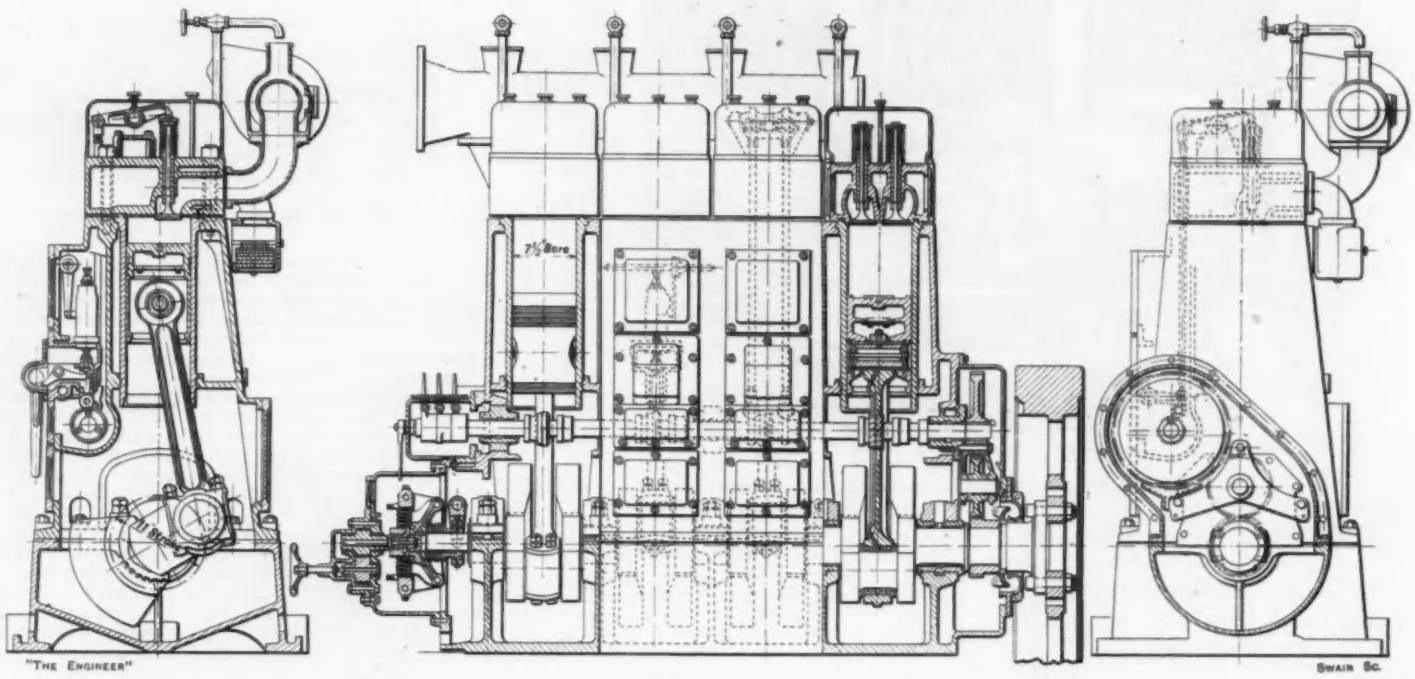


FIG. 12—CROSS AND VERTICAL SECTIONS THROUGH OIL ENGINE—NATIONAL

GEORGE SALTER AND CO., LTD.

Springs, spring balances, and weighing machines are naturally associated with the name of G. Salter and Co., Ltd., of West Bromwich, and this year there will be on the stand at Birmingham, a representative display of such appliances, including the balance shown in Fig. 14, which is capable of weighing up to 100 tons, and another of similar design with specially prominent markings, so that it may be easily read from a distance, or, say, through the smoke rising from a ladle of molten metal. A smaller machine for 2 tons is stamped by the Weights and Measures Inspector of the Board of Trade, and there will be yet another of 10 cwt. capacity which itself weighs only 48 lb.

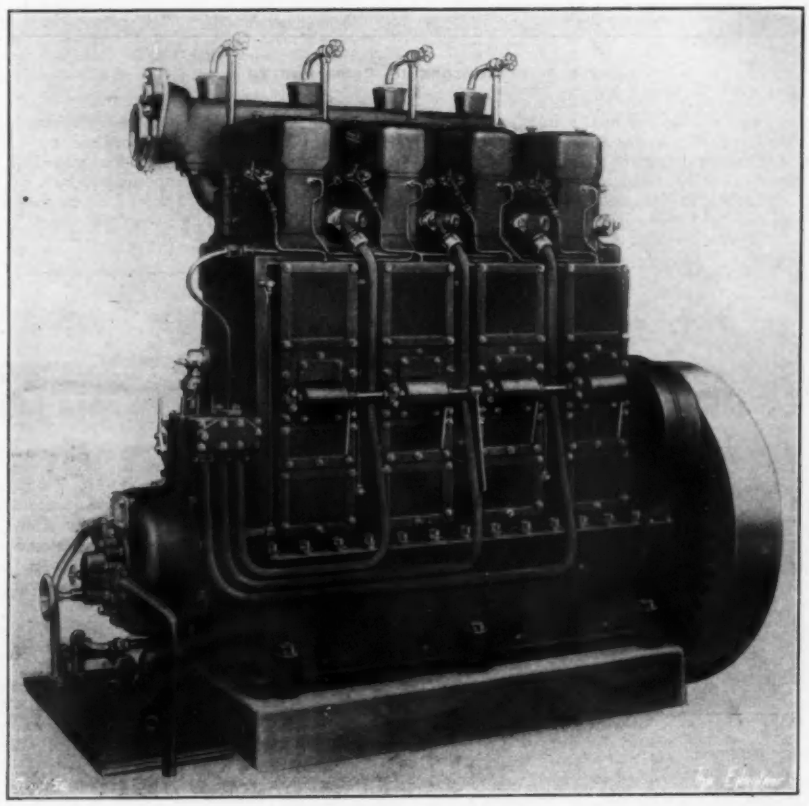


FIG. 13—100 B.H.P. FOUR-CYLINDER OIL ENGINE—NATIONAL

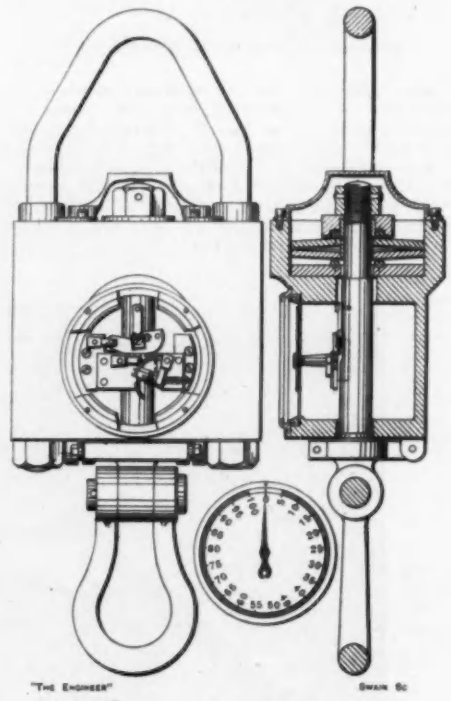


FIG. 14—100-TON BALANCE—SALTER

In all these machines the weight is measured by the deflection of a pair of Belleville washers, as shown in the diagram. These spring washers are naturally robust and are not likely to suffer any harm if they are suddenly loaded, as, for instance, if a crane load is picked up quickly, and they have the merit of a small deflection for a large load, so that the indicating mechanism does not require a large reducing ratio. It will be noticed that the load is applied to the washers through the intermediary of two rings, so

that rubbing friction is eliminated, and that a safety washer is provided to prevent the weighing washers being damaged if they are overloaded. The bale which carries the balance goes right through the casing, to the bottom, where it is secured by nuts, while the spring washers are at the top of the case. The cast iron case is therefore in compression, while the steel parts are in tension.

On this stand there will also be a variety of pressure gauges for both steam and water, of the Bourdon and the Schaffer types, and some helical roller bearings made of chrome-vanadium steel.

W. AND T. AVERY, LTD.

It is hardly necessary to say that on the stand of W. and T. Avery, Ltd., Soho Foundry, Birmingham, there will be a variety of weighing machines, the construction of which is familiar; but there will also be a machine which has been devised by this firm for

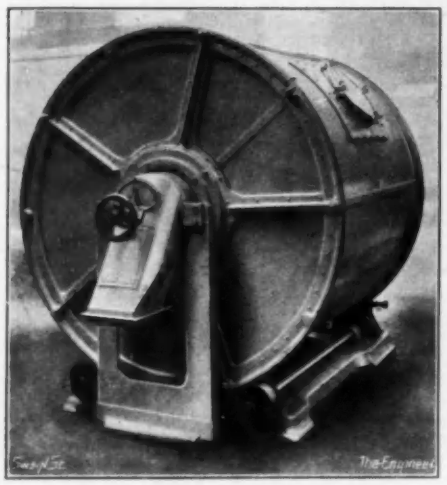


FIG. 15—BLENDING MACHINE—AVERY

testing its own machines in the works, that is interesting, although it is, naturally, not a product for general commerce.

Unless a visible weigher has been correctly assembled and manufactured of the best materials it will probably indicate correctly for the first few times and then fall away rapidly from the standard of accuracy laid down by the makers and the Board of Trade. Such a machine, if sold, would, naturally, be the cause of considerable trouble and dissatisfaction on the part of the scale user, and it is for the purpose of eliminating any possibility of failure of their machines from this cause that the Avery company has produced this endurance tester.

Briefly, the apparatus consists of two angle iron end frameworks erected in an inverted V formation, between which are held two platforms, one above the other. Between the apices of the end frames there runs a mild steel shaft supported by three oil retaining bearings. Arranged along the shaft are four cams, which are held so that, although they cannot move laterally along the shaft, they can revolve freely, independently of the movement of the shaft. Sliding on fixed keys on the shaft are four clutches which engage, by means of dogs, with the cams and rotate the cams at the shaft speed. The cams can be easily disengaged when required. In connection with the cams there is a set of presser feet which are held in the normal or upper position by coil springs. The lower end of each foot is fitted with a rubber shock absorber. The machine is driven by an electric motor through a roller chain and reduction gear. The speed of the shaft is 6 revolutions per minute.

The machines to be tested are placed in position on the platform so that a presser foot is directly over the weigh plate. The foot is adjusted so that it nearly makes contact when the machine is at zero; this ensures the weigh plate being depressed to the full extent of the cams, and the weighing machines being tested to practically full capacity. The quick return of the foot adds to the severity of the test. All Avery visible weighers have to undergo this trial and must show no subsequent difference in indication. Apart from the standard tests applied to all machines special long-time tests are applied to new models, special machines, &c.

Another novel exhibit on this stand will be the blending machine, illustrated by Fig. 15, which has been produced for the thorough mixing of dry powdered materials, such as those used in the electrical industry for insulators and bases.

In construction the Bartlett blender is comparatively simple, comprising a drum-like structure supported on four rollers. The drum itself is revolved through the medium of a worm wheel and worm drive by means of a 4 horse-power motor, and by this the bulking and discharge is obtained. Three types of mixing vanes are employed, known as the "baffle," "wing," and "cup" plates. The baffle plates, one top and one bottom, run across the drum. The wing plates extend spirally from end to end of the drum and are fixed to the drum shell. The cup plates are fitted at the front end of the wing plates, and are for discharge purposes. The wing vanes turn the material over in one direction and the baffle plates have a reverse turning effect. As a result the material receives a thorough blending in a very short space of time. Thus a 1-ton blend can be carried out in approximately twenty minutes and the machine will discharge its contents to the last ounce. Special precautions to make the machine dust-tight are taken, and any point at which dust is likely to escape is caulked with strip aluminium. The method of discharge is also dustless, and as the feed opening door is made so that it can make a tight joint with the feed spout, the whole operation of filling, blending, and discharging takes place with complete absence of dust.

J. P. UDAL.

An ingenious form of guard for preventing the operator of a pressing machine from getting his hand entrapped between the tools is to be exhibited by Mr. J. P. Udal, of 45, Upper Dean-street, Birmingham. It is shown in its several different working positions in Fig. 16.

The method of operation of the device is as follows:—The outer framework of the guard and bottom bar are not driven from the press, but may swing forward against the resistance of a coil spring. There is an adjustable stop lever which butts against one of the guard brackets and sets this frame in the position required for working. The inner frame of the guard is driven from the press through a split driving lever gripping a cast iron sleeve on the left-hand side of the guard main shaft. When the press starts its downward stroke the inner guard frame is swung outwards through the outer frame. If this meets with no obstruction the outer frame remains stationary and the inner frame completes a small outward movement, and returns to its starting position on the upward stroke of the press. If the inner frame on its outward movement meets any obstruction, such as the hand of the operator, which prevents it moving through the outer frame, the hand is gripped between the two frames, which then move together and push the hand a long distance to a position of safety. The setting of the guard is very simple, and is controlled by two ⅜in. Whitworth nuts. When these

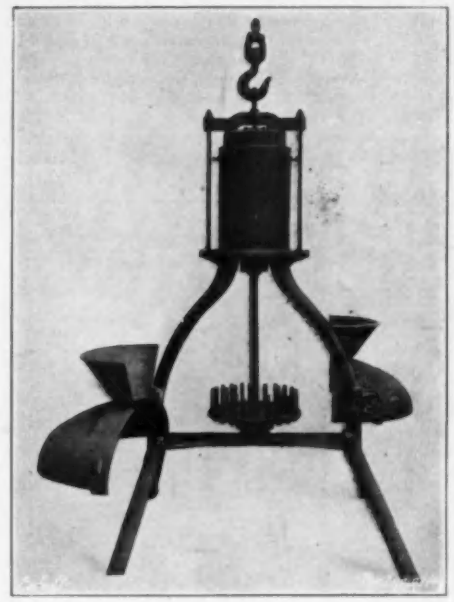


FIG. 17—SAND MIXER—PNEULEC

nuts are slacked off, the guard can be set to suit any size and height of tool, and on tightening the nuts, the guard is ready to operate. The great advantage of this guard is that it only makes the long safety movement when the hand of the operator is actually in danger. At other times its movement is small, and does not interfere with the working of the press in any way.

PNEULEC, LTD.

Most of the foundry equipment which will be shown on the stand of Pneulec, Ltd., Mafeking-road, Smethwick, Birmingham, such as a cupola, a core-sand mixer, and a Royer sand thrower, are familiar to our readers, but there will be a new machine in the form of the sand conditioner illustrated in Fig. 17.

As will be seen from the illustration, this is a very simple machine, and comprises a horizontal disc-shaped rotor fitted with two rows of vertical pegs. The rotor is mounted on a shaft with a roller footstep bearing, and is driven by an overhead motor of 3 horse-power—in this position the motor is clear of the dust and dirt of the foundry floor. The rotor

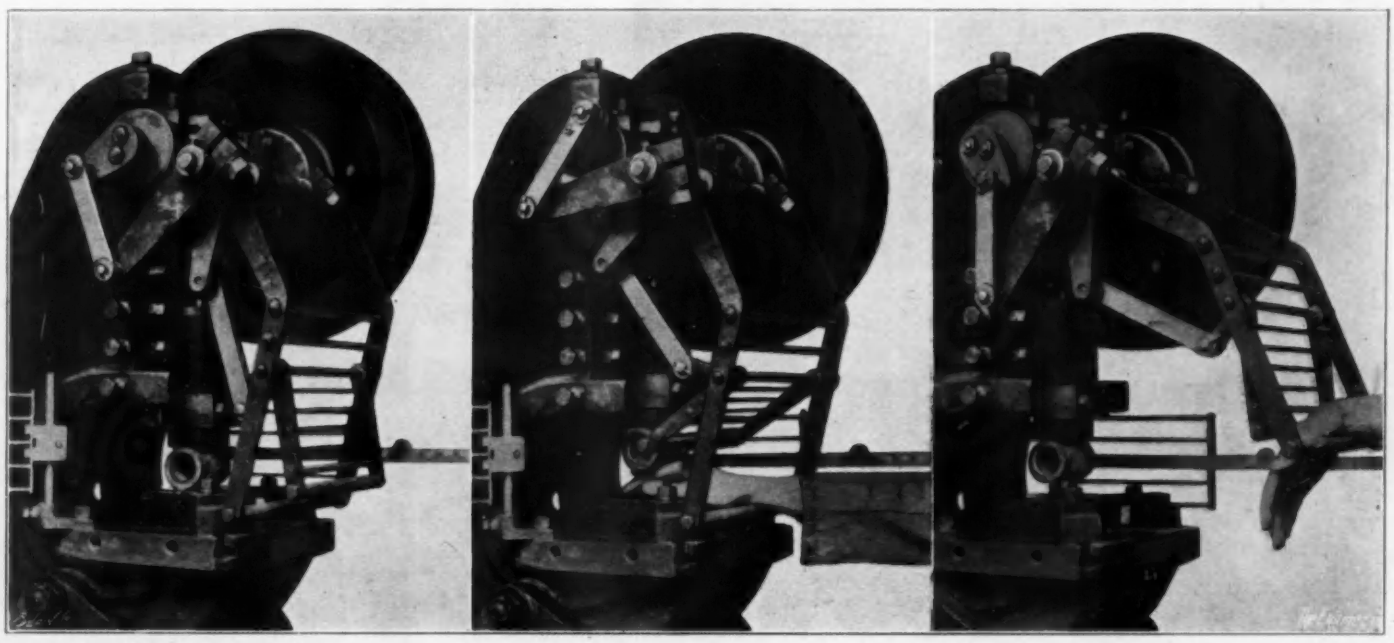


FIG. 16—PRESS GUARD—BOTTOM AND TOP OF STROKE AND OPERATOR'S HAND ENTRAPPED—UDAL

works inside a hood made in two pieces, and hinged to the legs of the machine. In the illustration it is shown open to expose the rotor. In operation the sand is simply shovelled into the funnel of the hood, and, being caught by the rotor pegs, is shot out and downwards to the floor. The action has the effect of breaking up any lumps in the sand and thoroughly aerates it, while bits of scrap metal cannot clog it up. The only wearing parts are the pegs, which can be very easily renewed. The machine will take sand as fast is it can be shovelled in and can be used either slung from a crane or standing on legs on the floor.

GEORGE ELLISON, LTD.

The exhibits of George Ellison, Ltd., of Perry Barr, Birmingham, will consist of switchgear for the control of main power circuits and machinery in industrial works of various kinds. There will be pole mounting air break switches for overhead power lines working at pressures up to 33,000 volts, and a new switch of this type for 11,000 volts. Cubicle and truck type, 11,000-volt, metal-clad switch units for indoor sub-stations, and 660-volt, metal-clad units for the control

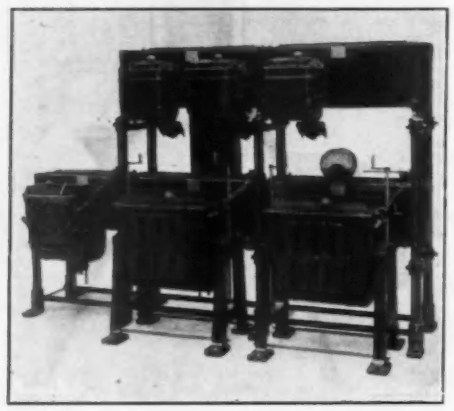


FIG. 18—DOUBLE TIER SWITCHGEAR—ELLISON

of the secondary side of power transformers will be shown, together with draw-out and non-draw-out types of power distribution switchgear and double-tier switchgear for sub-stations in which floor space is limited. For controlling motor-driven machinery several types of starting and protecting gear, including drum type controllers, star-delta, and auto-transformer starters and rotor resistance starters with circuit breakers will be exhibited. Limited switches, solenoids, cable end couplings and frame-proof circuit breakers, and starters for use in mines and in other places where the atmosphere may be inflammable will also be seen on the stand.

The metal-clad cubicle type of switchgear unit for

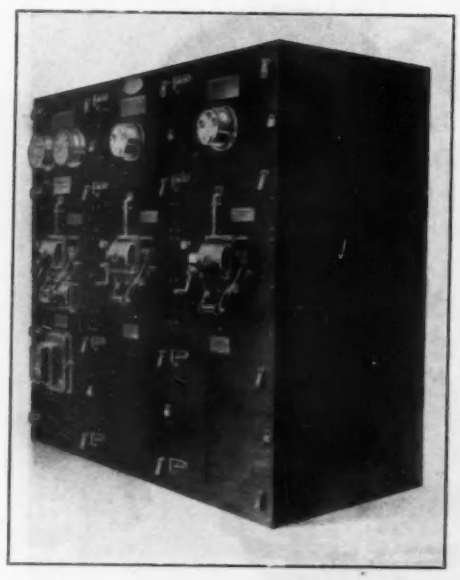


FIG. 19—11,000 VOLT SWITCHBOARD—ELLISON

11,000-volt sub-stations is claimed to offer great advantage from the point of view of general utility. Any combination of component parts can be arranged and housed without the restrictions and limitations of a cast iron erection. The cubicle can be subdivided and built as required, with all connections visible and accessible and the copper work can be covered with insulation. The circuit breakers are of high rupturing capacity and fitted with the usual automatic releases. The isolators may be operated by a hooked insulated rod, or by a lever handle on the front of the board and interlocked with the breaker. Interlocks are arranged to prevent operating mistakes and to secure the doors. The illustration, Fig. 19, shows a three-unit consumers' substation switchboard of this design, as standardised by the Birmingham Corporation electric supply department.

The truck type unit for 11,000-volt sub-stations—see Fig. 20—is claimed to be the ideal form of switchgear where sufficient space can be allowed for the removal of the truck which carries the circuit breaker, &c. It combines the principles of the metal-clad cubicle and the draw-out unit. Interlocking devices

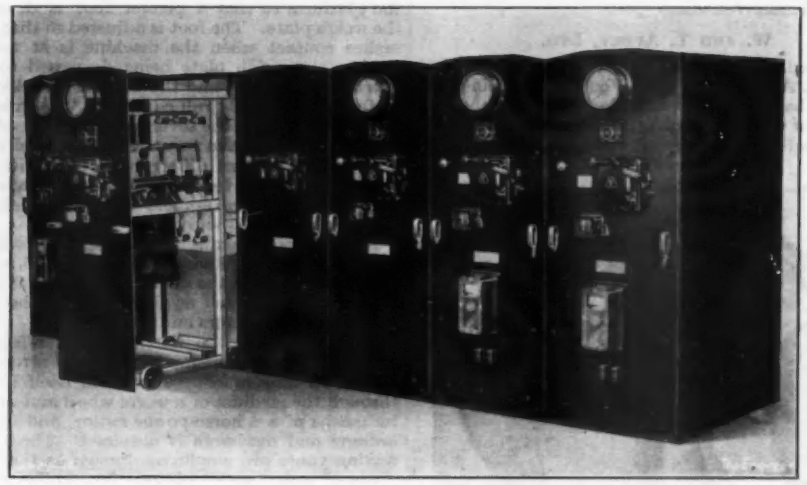


FIG. 20—11,000 VOLT TRUCK TYPE SWITCHGEAR—ELLISON

ensure the operator's personal safety and prevent switching mistakes. Although the component parts are spaced according to British standard specification, the connections are covered with insulation. The parts which require attention are readily accessible, and special precautions are taken to ensure that the trucks are interchangeable. Overload, leakage and no-volt automatic releases and the usual instruments with current and voltage transformers are provided.

The firm's draw-out and non-draw-out metal-clad switchgear with the circuit breakers mounted in line on a continuous bus-bar chamber are now widely used for the control of power at working voltage and are installed in works and sub-stations. Where space is limited, the gear offers advantage, and the non-draw-out type of gear can be arranged in two tiers, as shown in Fig. 18. If the upper circuit breakers are of

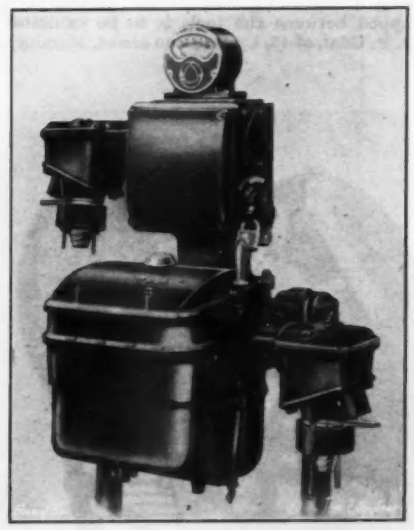


FIG. 21—INDUSTRIAL BREAKER—ELLISON

fairly small size, they can be operated from the floor level, but if larger breakers are necessary, a portable platform is provided. The circuit breakers are of the standard all-enclosed type, with automatic releases.

The industrial circuit breaker shown in Fig. 21, which is adaptable for all kinds of cable connections, has been specially designed for use in works of all sorts. It is strongly made, and is provided with a stout lever for closing and a striking knob for opening, and is perfectly safe. The breaker has good rupturing capacity, and the automatic trips are accurately adjustable from normal load up to 150 or 200 per cent. overload. With time lag devices fitted to the overload trips, the breakers can be set to operate at the safe overload rating of the motor, or can be used for "direct-on" starting. The trip and time lag devices are enclosed, and can be padlocked to prevent interference. The isolator enables the breaker to be safely inspected by the maintenance man without switching off at the main switchboard. The illustration shows a typical breaker fitted with sealing end fittings for armoured cable, an isolator and ammeter.

The illustration, Fig. 22, gives a back view of one of the firm's standard mining circuit breakers, which are generally fitted with a plug for a trailing cable and coupler fittings for an armoured feeder cable. The breaker is of the magnetic blow-out type, and is enclosed in a welded steel flameproof box mounted on skids, with the trailing cable plug interlocked with the breaker handle and feeder cable couplings at the back of the box. In the illustration the cover has been removed in order to show the links which provide means for looping in. The cable end fittings are finished off on the cable before going into the pit, and the assembly is then a simple matter. When the breaker has to be moved forward to a new position, the cable end fittings are coupled together, and the

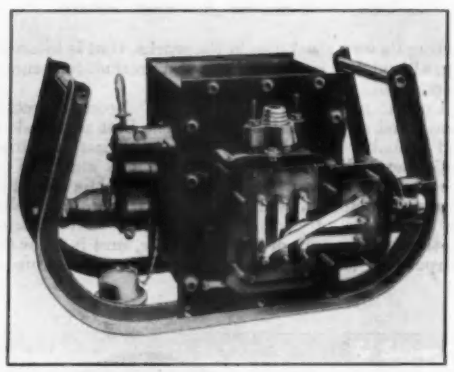


FIG. 22—MINING CIRCUIT BREAKER—ELLISON

new length of cable with its own end fittings is bolted up.

THE RAY ENGINEERING COMPANY.

The stand of the Ray Engineering Company, of Waterdale Works, Southmead, Bristol, will be devoted entirely to low-tension switchboards and switchgear.

FIG. 23—SHIP'S SWITCHBOARD—RAY

The totally enclosed metal-clad lighting plant switchboards introduced by the company some years ago are being shown, together with a new and improved type that has just been put upon the market,

Another recent product is the automatic emergency lighting switchboard for ships—shown in Fig. 23—which is designed for changing over the lighting circuits to an emergency battery, in the event of the main supply failing. Normally, the main switch is kept closed and is only used for isolating purposes. When the battery is fully discharged a charging contactor automatically closes and remains closed until the cells are fully charged, when it is automatically opened. During the charging period a red pilot lamp indicates that current is being supplied to the battery. In the event of the main supply failing, the emergency contactor operates and causes an auxiliary battery contactor to close, thereby connecting the emergency lighting circuits to the battery, which provides the supply until the main supply is renewed. During the time the battery is providing the current a pilot gives a green light. In the event of the main switch being accidentally opened or any of the fuses being removed, the emergency battery and green lamp are brought into action. If it should be necessary to give the battery a freshening, or boosting, charge, the pointer of the ampère hour meter is set back to the requisite distance, and on pressing an emergency push-button the battery is put on charge, the charging current being discontinued automatically when the cells have received the desired number of ampère hours.

MELDRUMS, LTD.

Meldrums, Ltd., of Timperley, near Manchester, will have a model of a Lancashire boiler fitted with the mechanical stoker illustrated by the line drawing, Fig. 25.

This machine is of the sprinkler type, in which the coal is thrown on to the fire by a rotary beater, and

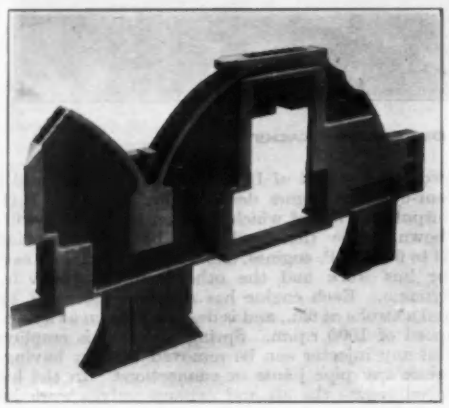


FIG. 24—FURNACE FRONT PLATE—MELDRUMS

one of its peculiarities is the design of the front plate on which the mechanism is mounted. As will be seen from Fig. 24, it is hollow, and it is supplied with air by steam jet blowers. The air traverses right round the front, and is delivered over the fire for supporting the combustion of the fuel. In this way the air is preheated, the stokehold is kept comparatively cool, and the liability for the front to be cracked is reduced. The front is made in two pieces, one for each furnace,

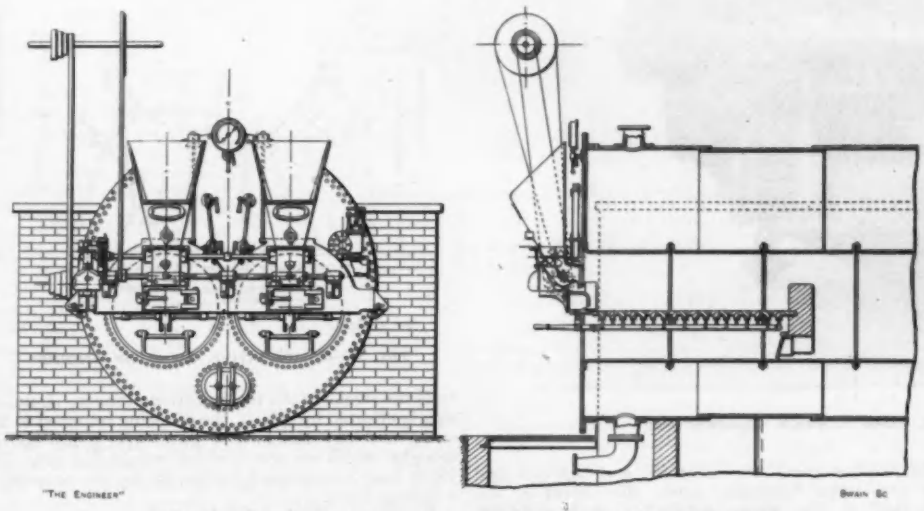


FIG. 25—MECHANICAL STOKER WITH ROCKING GRATE—MELDRUMS

and the facings necessary for the attachment of the various fittings are all machined. The whole assembly is fixed on the boiler end plate by clip bolts.

The coal is fed into the stoker from two hoppers, below each of which—see Fig. 25—there is arranged a four-vaned distributor of cast iron, operated by a pawl and ratchet, which gives control over a wide range of speed. This distributor regulates the feed of the fuel to the stoker. The coal is then thrown on to the fire by a two-bladed beater, running at 800 revolutions per minute, the two blades of which are curved in such a form as to give an even distribution of the fuel over the grate. The shaft for this beater is mounted in bearings away from the coal feed, fitted with steady pegs for ease in re-erection and to ensure alignment of the shaft. It is claimed that this constantly rotating beater is more satisfactory than the reciprocating type of shovel on account of its simplicity. The regulator is driven through worm gearing. This gearing is machine-cut and mounted in an oil-tight gear-box. A four-speed cone pulley is provided to give additional regulation in the forced draught machine, and draught is provided by two steam jet blowers, the steam for these being superheated in the boiler side flues. In the rocking grate type, which we illustrate, alternate bars are rocked by a separate lever. The bars run from side to side of the flue, and are mounted in substantial side bars having bearings for the support of the bars. This type of grate is recommended for fuels which produce a large amount of ash not liable to clinker.

THE DISTRICT IRON AND STEEL COMPANY, LTD.

The principal exhibit of the District Iron and Steel Company, Ltd., of Smethwick, will be an example of the Broughton-Hadlington gas producer, illustrated by the drawings, Figs. 26 and 27. The chief peculiarities of this producer are the arrangements

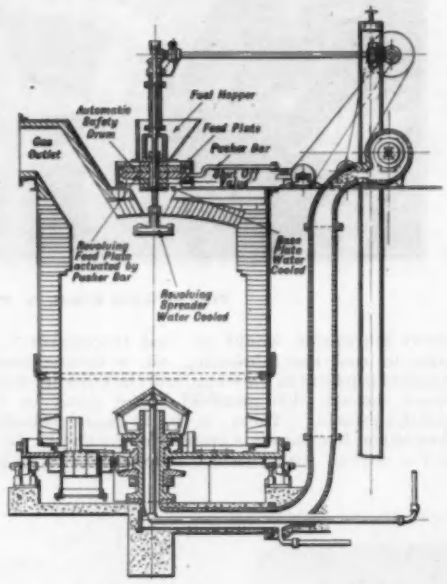


FIG. 26—GAS PRODUCER—DISTRICT

for sprinkling in the fuel, as shown in Fig. 27, and for ash removal—see Fig. 26.

The fuel is automatically fed into the hopper, preferably from an overhead bunker, and so through the two apertures in the top feed plate, and the corresponding openings in the emergency valve. As the pockets in the lower rotating valve coincide with the apertures in the plates or valves above, they fill with fuel, and on registering with the openings in the lower fixed water-cooled valve or plate, the fuel is discharged on to the distributor below, which rotates at 160 r.p.m. There are no mechanical pokers or levellers, the rotating distributor being so designed as effectively to scatter the fuel evenly over the fire bed. Should a large lump of coal, or any foreign substance, get into the fuel supply and be unable to pass through the valves, the emergency valve—normally stationary—is brought into action by an automatic device, which attracts the notice of the attendant, and the substance fouling the mechanism can be removed.

In case of need, the shutting-off valve below the rotating valve can be turned so as to close completely the top of the producer.

The automatic ash discharging gear comprises a rotating pan underneath the ash bed, having an outlet to an ash box, this ash box being fastened to the rotating pan. At the bottom there is an outlet, at the back, controlled by a sliding door for the discharge of the ashes. Inside this ash box there is a crushing roller, fixed in a position just above the bottom of the pan. This roller is also fastened to the rotating pan, and is worked by a shaft and bevel pinion wheel from a crown wheel underneath, fixed to a stationary centre shaft, which is hollow. This shaft forms a blast-pipe, and communicates underneath the blast-hood with the inside of the producer. As the pan rotates, this crushing roll rotates inside the ash box, bringing down ashes and crushing clinker in small quantities, and leaving

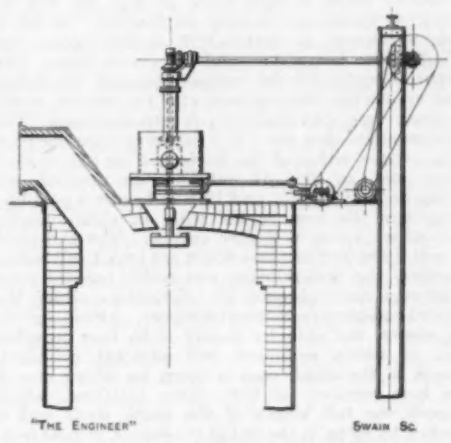


FIG. 27—DISTRIBUTING GEAR—DISTRICT

them behind the ash box in a water seal bottom. Behind the ash box there are scrapers fastened to the rotating pan, which collect ashes, and deposit them in a truck or conveyor to be cleared away. The chief feature claimed for this automatic ash discharge is the facility with which ashes are removed in small quantities from every part of the fire bed. Blocking or scaffolding inside the producer, which would interfere with the even distribution of air and steam going to the fire bed, is thus avoided. There are fastened to the rotating pan, and underneath the fire bed, two long fingers and two short ones. These fingers force their way into the ashes or clinker, breaking up any clinker and keeping the fire bed generally free. They are so arranged as to push towards the centre of the fire bed. Arranged underneath the blast-hood and fixed on the centre shaft are four arms, fixed in such a position that as the pan and blast-hood rotate, they force back ashes into the centre of the main fire bed. These arms, working in conjunction with the fingers on the outside of the fire bed, keep the fire free from any blow-holes.

T. BRADLEY.

There will be a number of drilling machines on the stand of Mr. T. Bradley, of Alexandra Works, Church, Accrington. Among them there will be the pillar

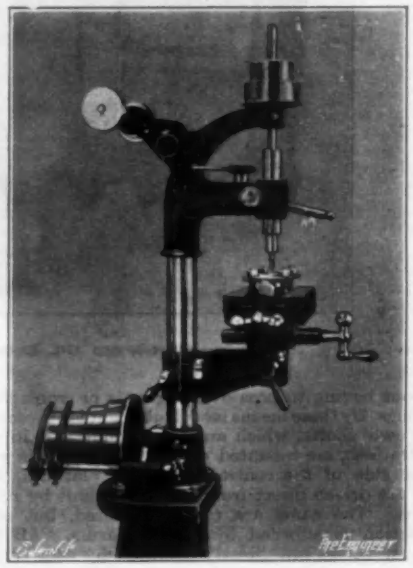


FIG. 28—PILLAR DRILL—BRADLEY

machine shown in Fig. 28, which has been designed to fill the demand for a small and inexpensive key-seating, slot milling, end milling, and drilling machine

combined. The feed has a vertical movement of 2½in., and is operated by a fine small worm engaging with the pinion which operates the drill sleeve. The compound slide rest has a table measuring 12½in. by 6in., and has travels of 3in. and 8in. It can be turned in any direction. There is a clearance of 6¼in. between the centre of the spindle and the column and the maximum distance from the spindle nose to the table is 12in. The spindle is bored No. 1 Morse taper, and is intended to take drills up to ½in. diameter. It is fitted with a ball thrust bearing. For large work a second table can be fitted to the base, when jobs over 3ft. high can be accommodated.

BLACKSTONE AND CO., LTD.

An exhibit of outstanding interest on the stand of Blackstone and Co., Ltd., of Stamford, will be a new type of spring injection, heavy-oil engine, in which the eight cylinders are arranged in two groups of four, inclined at 45 deg. to a perpendicular passing through the centre line of the crank shaft. The engine, a view of which is reproduced in Fig. 30, will be shown in operation, running on fuel oil. It has a designed output of 1250 B.H.P. at 250 r.p.m., the cylinder bore being 18in. and the stroke 24in. The design is applicable for engines required for industrial or electric driving and also for marine work, in which case low headroom is advantageous. The builders claim that the "V" engine is more compact than engines either of the horizontal or the vertical types, and, as Fig. 31 indicates, an approximate saving of 7ft. in height and 12ft. in length is possible, comparing the new engine with an eight-cylinder vertical engine of a similar output. The bed-plate is built up in four sections which are keyed and bolted together, the design being one which ensures good alignment and absence of distortion, while the divided bed-plate facilitates transport. As our engraving shows, the cylinder casing is in four sections, each of which embraces two adjacent cylinders. Access to the crank case is given by lifting one of the four sections of the centre platform, which extends the full length of the crank shaft and is reached by steps at the end of the engine, remote from fly-wheel. The pistons may be quickly withdrawn through the crank case, a patented balanced sling being employed for that purpose. The connecting-rods for opposite pistons are coupled side by side without bifurcation to a crank pin common to both of them. The air displaced by the pistons is equalised through conduits formed in the engine casing, which connect the two crank cases and allow the air displaced by the two sets of four pistons to be transferred

FIG. 30—1250 B.H.P. V TYPE OIL ENGINE—BLACKSTONE

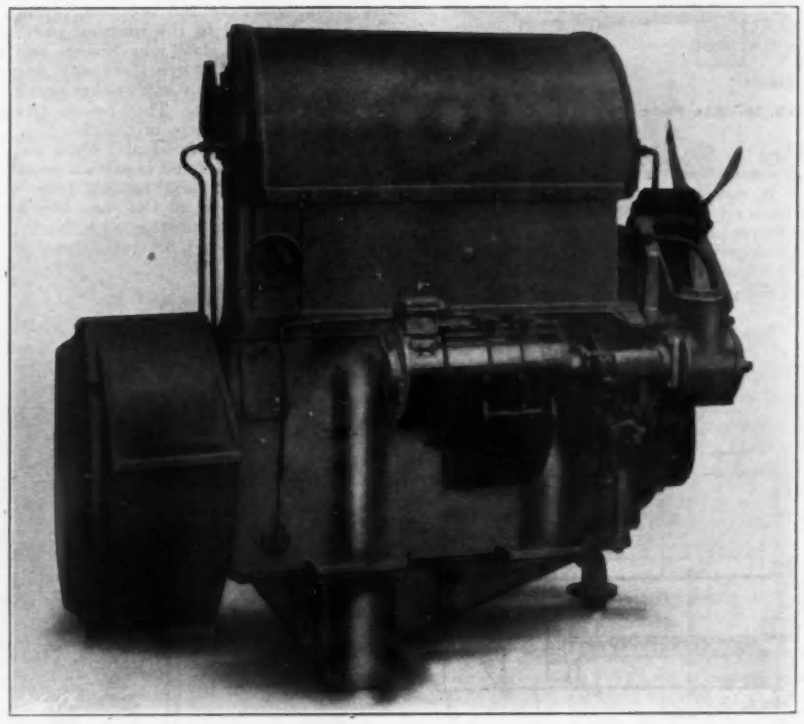


FIG. 29—HIGH-SPEED OIL ENGINE FOR ROAD SERVICE—BLACKSTONE

without having to pass over big ends or crank shaft bearings. By these means loss of lubricant is prevented. The cam shafts, which are clearly indicated in our illustrations, are mounted on the cylinder casings at either side of the central inspection platform, and they are driven direct from the crank shaft by roller chains. The cams are totally enclosed, but easy inspection is afforded by hinged covers. All the exhaust valves are directly operated by cam levers, while the air valves, which are situated at the lower sides of the cylinder heads, are operated by push-rods and rocker arms. The design employed enables the air and exhaust valve casings to be readily removed for examination. The fuel valves are arranged at the ends of the cylinders and the standard Blackstone governor-controlled, spring-injection principle is used. The engine is furnished with forced feed lubrication to the main bearings, the cross-head, and the big end bearings, while the cam shafts are ring-oiled and the enclosing casings form an oil bath into which the cams dip. For marine work forced lubrication would be used throughout. In order to cool the lubricating oil, a cooling water manifold is placed in the sump, and the entering water passes through this manifold before going to the cylinder-jackets. There is a 21-point standard Cambridge Instrument Company's pyrometer fitted to the engine, with thermocouples arranged at the eight exhaust ports, the eight big end bearings and the five main bearings, while thermometers are provided at the water outlets on each cylinder. Designs have been prepared embodying the patented "V" arrangement described for engines with eight, twelve and sixteen cylinders, embracing a wide range of powers.

No actual running results are available, but we are given to understand that the exceptionally low fuel and lubricating oil consumptions associated with the Blackstone horizontal engines, have been maintained in the new design.

The firm will also exhibit two other engines running on fuel oil, comprising horizontal single-cylinder engines of 6 and 55 B.H.P. output respectively.

A recent development of the Blackstone spring-injection engine is a high-speed light engine, specially designed for road transport; a Leyland lorry with a Blackstone six-cylinder, heavy-oil engine will be shown at the Fair. The exhibits on Messrs. Blackstone's stands will include four of these engines. A two-cylinder unit of 18 to 20 B.H.P. output and the four-cylinder engine designed for 36 to 40 B.H.P. output—a view of which is given in Fig. 29—will be shown, while there will also be two six-cylinder 55 to 60 B.H.P. engines, one with an aluminium casing for bus work and the other coupled direct to a dynamo. Each engine has a cylinder bore of 4¾in. and a stroke of 6in., and is designed to run at a normal speed of 1000 r.p.m. Spring injection is employed, and any injector can be removed without having to break any pipe joints or connections. In the high-speed engine the air and exhaust valves work horizontally, the exhaust valve being arranged opposite the air inlet passages, and both valves are driven by push-rods and rocker arms. The engines have cast monobloc cylinder casings, with detachable cylinder heads and renewable liners. A ball lift governor con-

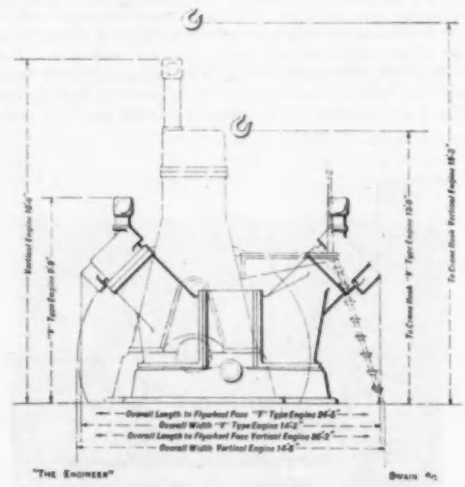


FIG. 31—COMPARATIVE SIZES OF ENGINES

trols the stroke of the fuel injection plunger. Lubrication is effected by splash, the oil being returned to the sump and circulated by a gear type pump to the troughs, which are arranged below each big end. The valve gear is made easily accessible by the removal of a sliding cover.

For the smaller engines hand starting is used, but either electric or petrol engine starters are supplied with the larger engines.

Other examples of Blackstone productions will include single and twin-cylinder engines of 17 and 64 B.H.P. respectively, the large engine being employed to drive a dynamo, while a large number of small petrol-paraffin and petrol engines will be shown, as well as a series of the firm's "Unchokeable" pumps, some of which will be exhibited in operation.

THE ENGINEER.

The British Industries Fair at Birmingham.

The British Industries Fair.

In this Supplement and in the pages of this issue we continue the account of the exhibits in the Birmingham section of the British Industries Fair which we started in the Supplement to our issue of last week.

The Bryan Donkin Company, Ltd.

Among the numerous photographs shown by the Bryan Donkin Company, Ltd., of Chesterfield, are many examples of Rateau turbo exhausting plants. The company holds the licence for the manufacture of turbo exhausters, compressors, boosters and blowers, and has now supplied over 290 to gasworks, coke oven installations, &c. Models of two-blade and three-blade type exhausters are also exhibited on the stand. Another speciality of the company is gas valves. Models are exhibited of high and medium-pressure double-faced valves, the single-faced rack and pinion valve, the worm and rack valve, and also a disc valve for use with purifiers. A photograph is shown of a 48in. diaphragm gas governor at the Nechells works of the City of Birmingham Gas Department. This is the largest of its kind in use in this country. There is also a photograph of an installation of special Reynolds' high-pressure district governors at Kings Norton, which are reducing the gas pressure from 15 lb. per square inch to the normal supply pressure.

This company is now developing in this country a high-speed turbo exhauster designed on the Rateau principle for speeds up to 10,000 r.p.m.

Sir W. G. Armstrong, Whitworth and Co., Ltd.

There is an interesting exhibit on the stand of Sir W. G. Armstrong, Whitworth and Co., of Scotswood, Newcastle-on-Tyne, in the form of a plant which has been specially devised for the re-metalling of the bearings of railway axle-boxes. It is shown in Fig. 1.

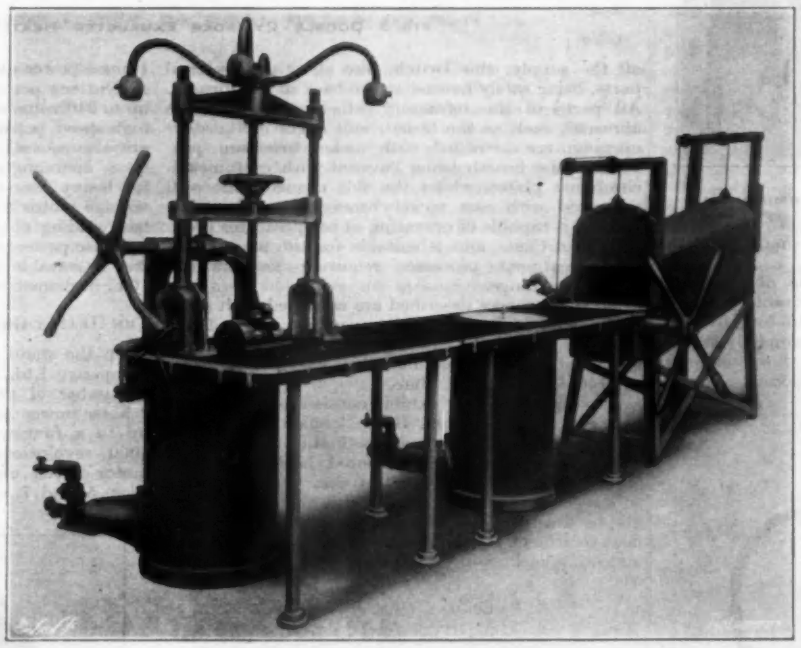


Fig. 1—Machine for Re-Metalling Axle Bearings—Armstrong

On the extreme right of the machine, as it is shown in the illustration, there is a chain conveyor de-metalling oven. The old shells are fed in at the upper end and are conveyed by a chain, operated by the handle at the lower end, through a heated chamber, during which period the old metal is run off into moulds. The heated shell is then tinned by immersion in the tinning bath shown in centre, after which it is placed on the die casting machine on the left. The lower half of the die is clamped over the nozzle of the cylinder and the top half is held by the overhead gear. The shell is inserted in the die; the top half is clamped over it, and metal is forced into the shell under pressure by operating the star hand wheel on the left. The bearing is then ejected from the die, and after trimming and removing the gate the shell is ready for service. The conveyor oven and die-casting machine are controlled by automatic heat regulators, which maintain a constant temperature. The plant exhibited is gas fired with syphon type burners, and is fitted with a heat regulator, but it can be fitted for burning oil, a pyrometer being then employed in place of the heat regulator.

There is also on this stand a semi-rotary, open-flame, brass-melting furnace of 350 lb. capacity, which has been designed to meet the requirements of small brassfounders requiring an output of 1 to 1½ tons per day of non-ferrous alloys. The furnace comprises a steel barrel lined with refractory bricks, or ram lining material, into which two burners, either gas or oil, fire directly opposite each other. The resultant flame is of a very good reverberating and blanketing nature, thus effecting rapid melting with low fuel consumption. Charges from 50 lb. to 400 lb. can, it is claimed, be very conveniently dealt with, with low fuel costs and high efficiency. The special lining supplied with the furnace will give, under ordinary working conditions, anything from 600 to 800 heats, and the cost of relining should not exceed £4 to £5. The furnace is specially designed to facilitate relining, and is of very robust construction, the principal parts being made of steel. The air pressure required, whether the furnace is fired with oil or gas, is about 1 lb. per square inch. There is also a pit type of furnace, for oil or gas firing, with accommodation for crucibles holding from 100 lb. to 120 lb. of metal.

Birmingham Electric Furnaces, Ltd.

The most interesting exhibit on the stand of Birmingham Electric Furnaces, Ltd., of Birlec Works, Tyburn-road, Erdington, Birmingham, is the "Birlec" furnace shown in Fig. 2. Although suitable for a wide range of applications, it is principally intended for the heat treatment of large quantities of small articles, such as nuts and bolts, ball races, gears, chain parts, &c. The principal advantages claimed for the furnace are that it uniformly treats large quantities of articles with a minimum amount of labour, automatically quenches its charge at the correct temperature, and each day precisely the same results are secured. The conveyor belt consists of cast nickel-chromium links joined together by nickel-chromium rods. It is provided with flanged sides, so that work will not roll off. The driving mechanism consists of two cast nickel-chromium drums, driven by an electric motor through variable-speed reduction gearing. Only a short length of the conveyor is exposed at the entrance end of the furnace for loading purposes. At the charging end the drum is mounted so that it can move longitudinally, the right amount of tension being applied to the belt by means of balance weights so that expansion or any stretch of the belt is readily taken up. The conveyor slides over smooth cast nickel-chromium hearth plates, which take the weight of the work, and returns on skid rails made of similar material. The heating elements consist of the usual "Birlec" heavy section nickel-chromium strip, supported on nickel-chromium hooks, situated above and below the conveyor, and a patented arrangement permits of exceptionally heavy rating on all the elements. This arrangement also makes the hearth elements immune from damage by falling scale. In accordance with the usual practice of the firm, the furnace is exceptionally well insulated throughout. The main points of the design are a very robust cast chain conveyor which never leaves the furnace, and is therefore always at a high temperature, the provision of a stripper, so that work can be discharged *viâ* a chute into the quench at any desired speed or angle, and a special type of hearth element which gives rapid heating and is unaffected by scale from the charge. Once the correct operating temperature and conveyor speed are set, skilled attention is unnecessary. The only operator required is a man to feed the parts on to the conveyor at the loading end, the material being automatically discharged from the quench tank by a separate conveyor. The furnace exhibited has a belt 24in. wide, the heated portion being 7ft. long. It has a maximum rating of approximately 70 kW, and is divided electrically into two zones, each of which is separately and automatically controlled to ensure the correct rate of heating and uniformity of final temperature. The output varies according to the class of work being treated, but under favourable conditions it is as high as 4 cwt. of steel parts per hour at 850 deg. Cent.

In view of the necessity of scientific accuracy in the hardening of modern high-speed tool steels, the firm has designed a new range of furnaces, the outstanding features of which are the accurate control of the temperature and uniformity and rapidity of heating. Proper working conditions are obtained in the furnace by a neutral or slightly reducing atmosphere, so that the steel being treated is not carbonised or decarbonised. Semi-burnt gases are admitted through a slit extending across the hearth at the door opening, thus effectively screening the furnace against the entrance of air. This prevents scaling of the work, and at the same time makes it possible to operate the furnace with the door open. The heating elements consist of "Globars," which extend from front to back along the two sides of the furnace, an arrangement which gives even distribution of heat, the hearth being fully heated without overheating any of the elements. The hearth—which consists of bonded silicon-carbide—is trough shaped, thus preventing the charge from damaging the heating elements, and the vestibule is so designed that the hearth can be removed and replaced without disturbing any portion of the brickwork. The furnace shown has a maximum rating of 20 kW, the hearth being 12in. long by 8in. wide, and the door 6in. high.

To work in conjunction with the high-speed steel-hardening furnaces described, the firm has introduced a new range of small box type furnaces, one of which is shown. In addition to serving as pre-heating and

tempering furnaces, they can also be used for hardening and other heat treatment processes requiring temperatures up to 1000 deg. Cent. The furnace shown has a hearth area, 16in. long by 8in. wide, a door opening 6in. high, and a maximum rating of approximately 9 kW. It is equipped with a transformer to give a low voltage on the furnace, so that heavy section strip heating elements, similar

FIG. 2—AUTOMATIC FURNACE—BIRMINGHAM

to those used in this firm's larger installations, can be employed. A special feature is that a heating element is fitted to the door, in addition to the hearth, sides, and roof, thus ensuring uniform heating of the whole hearth. The furnace casing is rectangular in shape and is built of mild steel plates and sections. All terminals, with the exception of

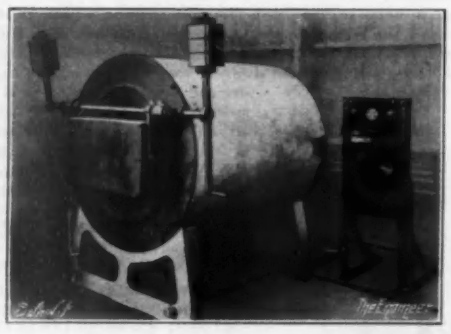


FIG. 3—PORTABLE FURNACE—BIRMINGHAM

those of the door element, are placed underneath the furnace, and are effectively guarded.

The illustration, Fig. 3, shows one of the firm's "Birlec" furnaces of the circular portable type, the furnace exhibited having a hearth 36in. long by 23in. wide, and a maximum rating of approximately 30 kW. The heating elements are similar to those employed in the firm's larger installations, and consist of heavy

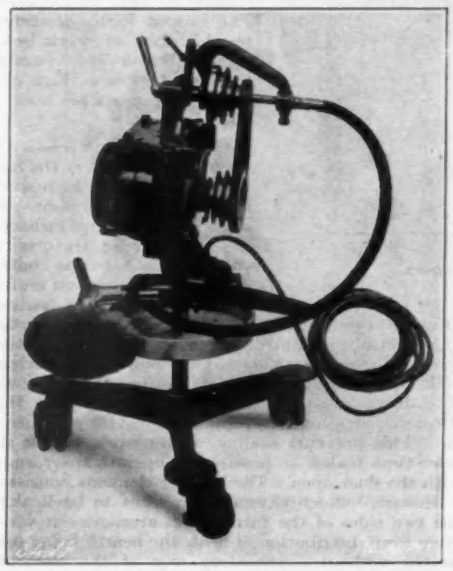


FIG. 4—FOUR-SPEED PORTABLE MACHINE—GILMAN

nickel-chromium strip bent into zigzag form, and supported on heavy gauge hooks, made of the same material. There is no contact between the element and the refractory, and all risks of "hot spots" owing to masking or of any interaction between the elements and the lining are said to be obviated, the result being a very considerable increase in the life of the resistors. The supports are placed at frequent intervals, so that no sagging or distortion of the element can occur. The furnace casing consists of a welded steel cylinder, which cannot easily be distorted or damaged, and, apart from the hearth, which is flat, the interior of the furnace is also circular. This construction, the makers explain, allows of free interchange of heat by radiation, so as to ensure even heating. The heat insulation varies in thickness from 6in. to 9in., according to the size of the furnace, and the purpose for which it is to be used. The makers' patented, parallel motion, insulated, socketed door is easy to operate, and is tight fitting without clamping. It is lined with refractory and insulation, the latter being covered with nickel-chromium sheet. The act of opening the door operates a switch which cuts off the supply, this switch, like all other electrical parts, being safely housed at the back of the furnace. All parts of the refractory which are subject to abrasion, such as the hearth and edges of the door opening, are provided with nickel-chromium protection, the hearth being covered with cast nickel-chromium plates, whilst the side elements are well protected with cast nickel-chromium guards. The furnace is capable of operating at temperatures up to 1000 deg. Cent., and is suitable for the majority of heat treatment processes requiring temperatures within this range.

All the furnaces described are equipped with automatic temperature control apparatus, part of the equipment comprising new potentiometric type regulators of British manufacture, which are being exhibited for the first time.

Another interesting exhibit consists of a full-scale half section of a large "Birlec" box type furnace, designed to show the robust method of construction, the insulation, and the patented heating element and its support. Owing to its size, it is impossible to show a complete furnace of this type, but photographs illustrate furnaces for annealing, the general heat treatment of steel and non-ferrous metals, bright annealing, carburising, hardening, vitreous enamelling, &c.

F. GILMAN (B.S.T.), LTD.

There are several new tools of the flexible shaft drive type on the stand of F. Gilman (B.S.T.), Ltd., 221, High-street, Smethwick, two of which are illustrated by Figs. 4 and 6.

The machine shown in Fig. 4 is driven by a

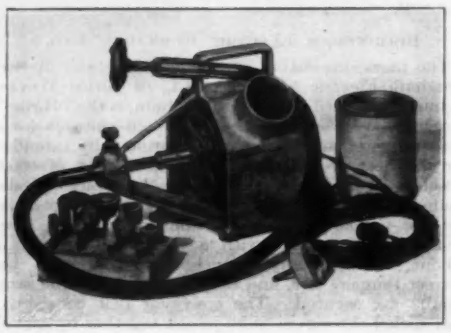


FIG. 6—⅛ H.P. FLEXIBLE DRIVE—GILMAN

⅛ horse-power motor, and is noteworthy through having a four-speed drive, by means of a rubber belt and cone pulleys. In this way speeds for the driving shaft of 850, 1750, 2375, and 3000 revolutions per minute are obtained. The belt is changed by means of two levers and this can be done quite quickly. The motor, together with the cone pulley bracket, is mounted on trunnions in a fork and the fork is carried by a pivoted stalk, so that it can be swung to face in any direction, and thus relieve the flexible shaft of bending strains. The flexible shaft runs in a steel-lined rubber covering. A variety of heads can obviously be worked off the shaft, and used for such work as polishing, grinding, and so forth. If required an extra high-speed motor can be fitted, when a maximum speed of 12,000 revolutions per minute can be obtained at the flexible shaft.

The little set shown in Fig. 6 is driven by a

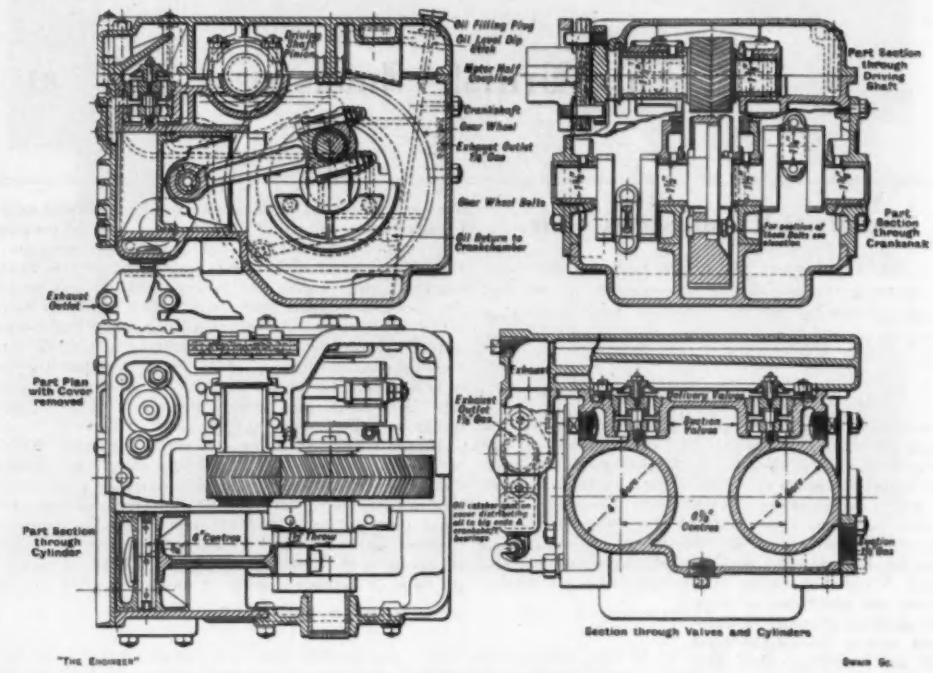


FIG. 5—DOUBLE-CYLINDER EXHAUSTER—HEATLY-GRESHAM

½ horse-power motor, and runs at either 4500 or 9000 revolutions per minute. It is intended for supplies up to 240 volts, and should be very useful for delicate, high-speed polishing, grinding, drilling, &c. There are also several other machines of the same general class, including one with a motor of 1½ horse-power for heavy foundry work, and another with a low-voltage motor for working in conjunction with electric welding outfits. This latter machine also is of 1½ horse-power, runs at 2800 revolutions per minute, and is suitable for grinding wheels of from 8in. to 10in. in diameter.

THE HEATLY-GRESHAM ENGINEERING COMPANY, LTD.

On the stand of the Heatly-Gresham Engineering Company, Ltd., of Letchworth, Herts., there are a number of petrol engines, ranging from a little 2 horse-power set driving a 1 kW lighting dynamo, up to a four-cylinder engine giving 28 B.H.P. at 1000 revolutions per minute. There is also a motor-driven exhauster, similar to that shown in Figs. 5 and 7, except that it will be mounted on a

FIG. 7—PORTABLE EXHAUSTER—HEATLY-GRESHAM

bed-plate instead of a trolley—the actual machine shown in Fig. 7 is being sent to the Buenos Aires Exhibition. As will be seen from the drawing, the machine is of the two-cylinder type, with cylinders 4in. in diameter by 3in. stroke, and is of a very compact design. The crank shaft runs at 600 revolutions per minute and is driven through double-helical gearing from a countershaft running at 1400 revolutions per minute. This shaft is connected with the motor by a flexible disc coupling. The gear runs in an oil bath and, incidentally, serves to lift

the oil into the top part of the casing, whence it flows to the various bearings. The casing is split horizontally to permit the introduction of the pinion shaft, while the crank shaft is put in through end doors. It will be noticed that the shaft has four bearings and is very substantial, so that whip and vibration are reduced to a minimum. The valves are thin plates held on to their seatings by light springs and are connected together, with the suction valve below and the delivery above, in such a manner that there is a minimum of clearance space, which, naturally, tends towards the attainment of a high vacuum.

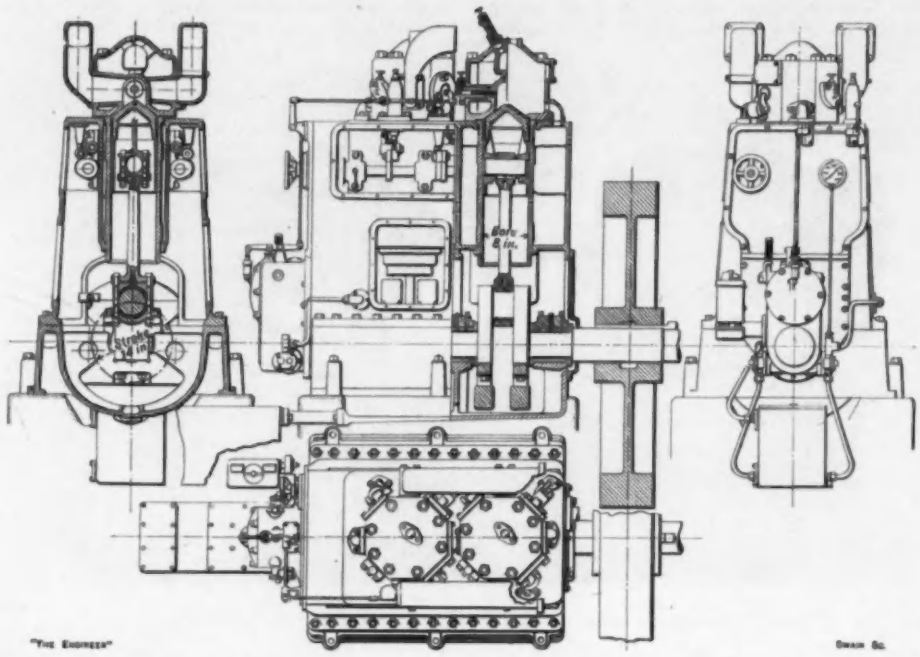


FIG. 8—TWO-CYLINDER VERTICAL OIL ENGINE—FIELDING AND PLATT

Both the valves can be easily taken out for cleaning, when the top part of the casing is removed. These exhausters have been primarily designed to work in connection with the brake equipment of locomotives driven by oil engines, when they may be driven either by a motor off the electrical equipment, or by a separate petrol engine. It may be mentioned that one of these exhausters has been fitted on the locomotive described in our issue of March 7th, 1930, page 266. The petrol engines to which we have referred in the earlier part of this notice are sufficiently well known to our readers to need no further comment.

FIELDING AND PLATT, LTD.

The largest exhibit shown on the stand of Fielding and Platt, Ltd., of Atlas Works, Gloucester, is the low-pressure horizontal cold-starting engine which we illustrate in Fig. 10. It has a designed working output of 60 B.H.P. at 240 r.p.m. with a maximum output of 65 B.H.P. The cylinder has a bore of 12½in., with a stroke of 22in. The principal features of the engine, to which reference

FIG. 9—OIL ENGINE INDICATOR CARD

has already been made in our pages in previous issues, include the firm's patented system of dual combustion chambers, which is also applied to the vertical engine illustrated in Fig. 8. The fuel pump is of the governed sleeve valve type, and the fuel atomiser is noteworthy for its simplicity, having a single aperture of appreciable diameter with a non-return valve. The construction is designed to avoid clogging, and many engines have run over three months continuously without having to clean the nozzle. The engine operates on the low-pressure, four-stroke, cold-starting principle, ease of starting being ensured by the provision of a starting spray, in addition to the spray from the working atomiser. When the engine has been run up to speed the starting spray is at once automatically cut out. The fuel consumption obtained is low, a figure of 0·42 lb. per B.H.P. hour being obtained for full load working with the larger engines, with a very slightly larger figure for smaller engines. In Fig. 9 we reproduce a typical indicator card taken from an engine running at 220 r.p.m. with an output of 79·5 B.H.P., the cylinder having a bore of 14in. and a stroke of 23in. It will be seen that the compression pressure is about 380 lb. per square inch, with a maximum pressure of 440 lb. per square inch.

An interesting new engine on the stand of Fielding and Platt, Ltd., is a two-cylinder example of the firm's new vertical engine, which embodies the principal features of the combustion chamber, fuel injection, and governing system referred to in our description of the horizontal engine. The model which is shown has two cylinders with a bore of 8in. and a stroke of 14in., and is designed to develop 50 B.H.P. at 400 r.p.m. The same cylinder output is used for the three and four-cylinder models, the last named of which is illustrated in Fig. 11.

As our drawing, Fig. 8, indicates, the design is noteworthy for its simplicity and compactness. The bedplate carries a box-shaped cylinder casing and crank case, into which the liners, which are made in specially hard cast iron, and finished by grinding, are fitted. The pistons, which are also ground, carry six upper rings and two scraper rings on the skirt. As shown, balance weights are attached to the crank webs. The cylinder heads or valve boxes are made as separate castings, and have an independent water jacket, thereby avoiding the necessity of a joint between the liner and cylinder head water spaces. The head joint is well removed from the combustion space. The fuel pump and governor are similar in design to those already referred to. Attention may be directed to the very neat arrangement of the cam shafts in the upper part of the crank case, these shafts being chain driven from the crank shaft. As may be noted from our illustration, accessibility is given by large-sized inspection doors. The engine is lubricated under pressure, there being two pumps for this purpose. One pump supplies clean oil at a high-pressure to all parts of the engine, while the other draws the oil from the crank chamber and passes it through a pressure type filter, delivering it to the oil sump, from which the first-named pump draws its supply of clean oil.

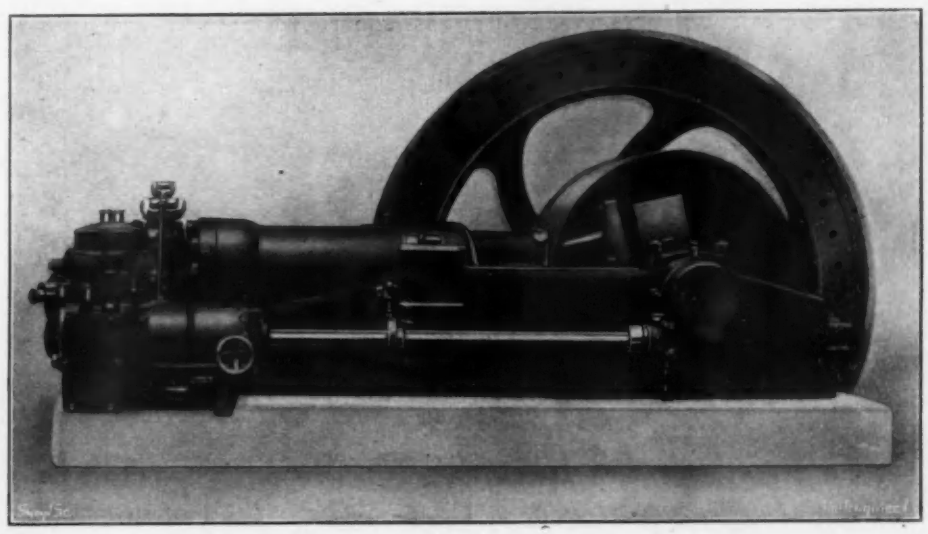


FIG. 10—60 B.H.P. HORIZONTAL OIL ENGINE—FIELDING AND PLATT

The series of engines we have described is being offered for both industrial and marine service. The fuel consumption is 0·42 lb. per B.H.P. hour at full load, and we understand that very quiet running is obtained. All starting operations are controlled by the movement of one hand wheel.

HUNT AND MITTON, LTD.

The most extensive of the exhibits on the stand of Hunt and Mitton, Ltd., Oozells-street North, Birmingham, is a range of steam valves in both bronze and forged steel for the high pressures which are becoming the vogue, but they require no special comment. There will, however, be some examples of a new form of grease lubricator, which is illustrated by Figs. 12 and 13. The component parts of these lubricators, it should be pointed out, are manufactured in Switzerland, but they are imported unassembled, and are put together, run in and tested in the Birmingham works.

The machine comprises a series of disc-shaped pumping units, each of which provides two feeds,

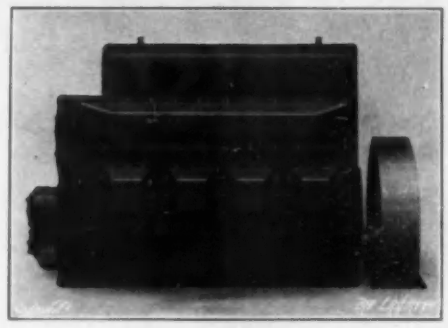


FIG. 11—4-CYLINDER VERTICAL ENGINE—FIELDING

that are assembled sandwich fashion, as shown in Fig. 12, with a grease container above. The whole assembly is held together by a central screwed rod. The container is a plain cylinder, with a lid clamped on by the handle shown, within which there works a piston for feeding forward the grease. The feed is effected by a screwed central spindle. The arrangement is such that when the container has been exhausted of grease it is only necessary to remove the cover, put in a fresh charge above the piston and invert the container, so that the grease is then below the piston again.

The driving section—which can be arranged for either a rotary or reciprocating drive as required, with various ratios of reduction for different speeds—operates both the piston in the grease container and the feed pumps, one unit of which is illustrated in Fig. 13. The container piston is drawn slowly down, forcing the grease into the small apertures of the feed pumps, when it comes under the action of the pistons, and is so forced to its destination. The rate of feed can be adjusted by the number of discs fitted under the hexagon heads of the pumps. The greater the number of discs the less the supply, until with six discs there is no feed at all. At its greatest output each pump can deliver 0·14 cubic centimetre of grease per stroke of the piston. A safety device is provided below the grease container, which permits the mechanism driving the latter to slip should the pressure in the container become too great. This prevents any damage to the apparatus if the delivery from the pumps is restricted or cut off entirely while the lubricator remains at work. Any number of pump sections can be provided, from one to eight.

Each pump-section can feed two points; that is, a maximum of sixteen points in all. If an odd number is required one half of a section can be cut out permanently by inserting six washers as explained before. The container holds about 2 litres of grease. When the container is empty a signal is given by the protrusion of a pin fitted just below its base. This pin is provided with a terminal, so that a connection can be made if required to an electric battery and bell. All the working parts are made of steel, hardened and ground, and every part is standardised, while the method of assembly permits of considerable

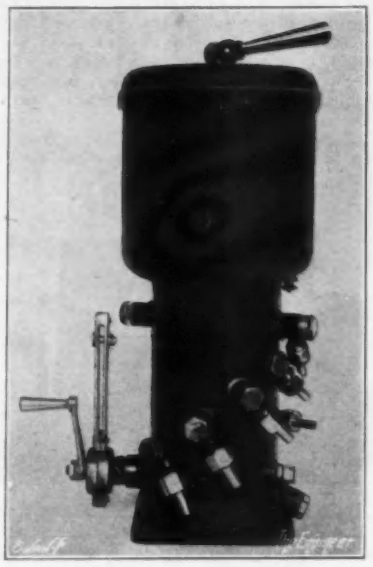


FIG. 12—MECHANICAL GREASE LUBRICATOR—HUNT

adaptability without upsetting the standardisation of the various parts.

HICK, HARGREAVES AND CO., LTD.

There are two rotary air compressors on the stand of Hick, Hargreaves and Co., Ltd., Soho Ironworks, Bolton, one of which is illustrated in the half-tone engraving, Fig. 14. It is of the single-stage, water-cooled type, and is capable of compressing 325 cubic feet of free air or gas per minute to a pressure of 30 lb. per square inch, when running at a speed of 720 revolutions per minute. It is, however, capable of working up to pressures of from 60 to 70 lb.

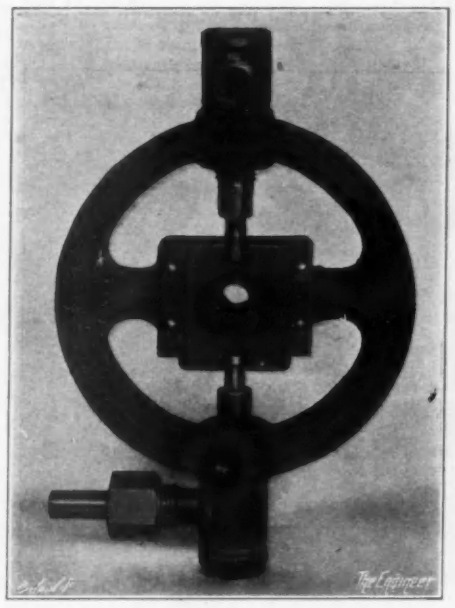


FIG. 13—PUMP SECTION OF LUBRICATOR—HUNT

per square inch. It is driven by a 40 H.P. B.T.H. motor, wound for an A.C. supply at 400–440 volts and 50 cycles.

The other machine is of the two-stage type, and is capable of compressing 35·5 cubic feet of free air per minute to a pressure of 100 lb. per square inch, when running at a speed of 1450 revolutions per minute. It has an intercooler arranged above the cylinders, automatic valve control, an air suction filter of the Vokes type, and a direct-driven mechanical lubricator. The makers inform us that they are making machines of this size directly coupled to A.C. motors, running at a speed of 1925 revolutions per minute, which can be switched direct on to the line. They work on a 220-volt three-phase circuit of 33⅓ cycles periodicity.

These machines are of the type in which a rotor is mounted excentrically in a cylindrical casing, and is provided with a number of radial blades. These blades are thrown out towards the casing by centrifugal force, but are restrained by rings, one at either end, which rotate with them and are housed in grooves in the casing. In this way undue friction and wear are eliminated, while the vanes are kept so close to the casing that a virtually gas-tight joint is obtained. The shaft passes through metallic glands at the end covers, which are lubricated mechanically. The governing of the machine is effected by means of a valve at the inlet, which is controlled by a piston subject to the delivery pressure. A non-return valve is also fitted in the outlet to prevent the machine being reversed when it is shut down. These machines

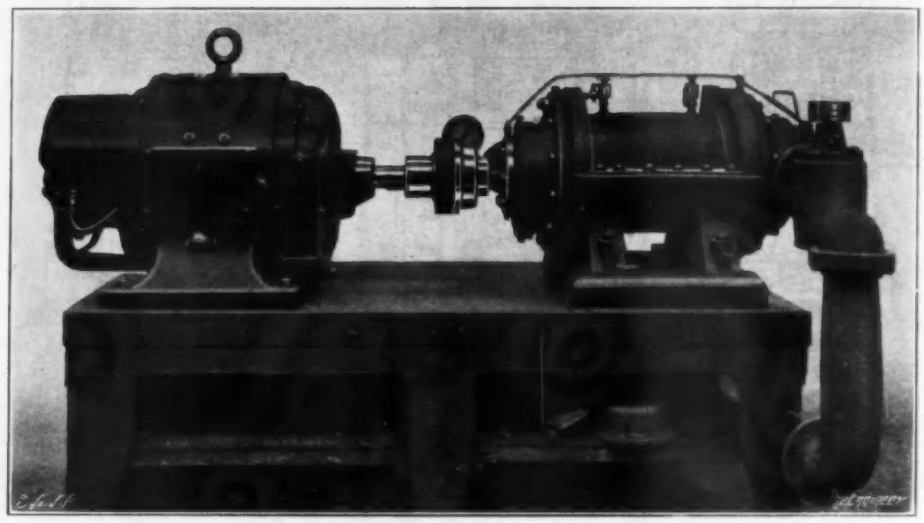


FIG. 14—SINGLE-STAGE ROTARY AIR COMPRESSOR—HICK, HARGREAVES

can, of course, be used as vacuum pumps as well as compressors.

J. H. HOLMES AND CO., LTD.

On the stand of A. Reyrolle and Co., Ltd., the associated firm of J. H. Holmes and Co., Ltd., is exhibiting a set of automatic street traffic control apparatus, as now used in many busy thoroughfares. The equipment, which is entirely of British design and manufacture, is claimed to be superior to foreign equipments that have been imported into this country, and it complies in detail with the recommendations set out in the memorandum—No. 297—recently issued by the Ministry of Transport. The lamp boxes—see Fig. 15—are of welded sheet steel construction, and are fitted with either near-side or far-side cast iron hoods, according to whether the boxes have to be mounted on the near or far side of the crossing.

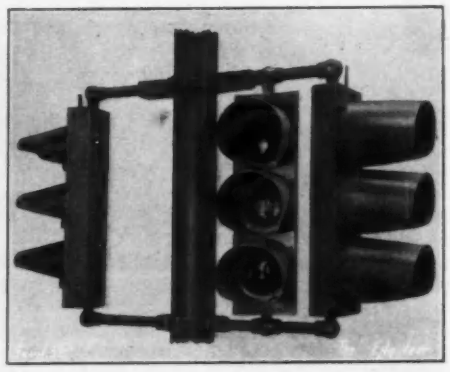


FIG. 15—THREE-WAY TRAFFIC SIGNAL—HOLMES

The hoods effectively screen the glasses from the sun's rays, and thus prevent the possibility of phantom signals being produced by reflection. Special diffusing glasses are used, and chromium-plated concave reflectors are mounted behind the signal lamps, which are fitted in an upright position to ensure maximum life. Each box is capable of rotation about its vertical axis to allow of adjustment on site to suit special conditions, and brackets for pole-mounting are available to accommodate the boxes necessary for one-way, two-way or three-way control. The control apparatus is housed in a cast iron box—see Fig. 16—which has two compartments, one containing all the mechanism, including the driving motor, protecting fuses and isolating switch contacts, while the other contains the control handles and levers. A separate door is fitted to each compartment, so that any adjustment to the timing device can be made in safety by a policeman or any other authorised person. The door to the main compartment is interlocked, so that the isolating switch handle—in the side compartment—must be moved to the "off" position before the door can be opened, with the result that all terminals are made dead before they are exposed.

For the convenience of testing, however, the switch is arranged so that it may be re-closed after the door has been opened. The timing device permits of variation of the green signal in both the main and cross-street from 5 seconds to 90 seconds in increments of 5 seconds. The amber signal can be initially set for any value between 2 seconds and 10 seconds, and arrangements are made for a trailing red signal, whereby the red signal is maintained during the cautionary amber period, prior to the green signal. A self-contained manual control switch is incorporated, and is interlocked with the motor control switch, so that the latter must be moved to the "off" position before the hand-control switch can be operated. Provision is also made to show a steady amber signal in all directions for night-time working when normal traffic has ceased. A universal motor, suitable for use on A.C. or D.C. circuits, is employed to drive the timing mechanism, which, owing to the reversible feature of the motor, is of the simplest possible nature. Exceptionally heavy contacts are fitted to the contactor switches, which are suitable for operating up to twelve crossings with single-way boxes, six crossings with two-way boxes, or four with three-way boxes.

The firm is also showing examples of its electric motors, including a variable speed A.C. commutator

FIG. 16—CONTROL BOX—HOLMES

machine, as described in our issue of January 16th of this year. The firm's totally enclosed, external fan-ventilated motors have been designed for service in situations requiring complete enclosure of the windings and working parts. The motor proper is enclosed by an inner dust-proof and weather-proof casing, and an outer casing, which is part of the motor frame, provides an annular space through which cooling air is driven by means of a fan mounted externally on the motor shaft. The particular motor shown is arranged for star-delta starting, and is rated at 28 B.H.P. at 770 r.p.m. and 440 volts. A flameproof motor exhibited—see Fig. 17—is rated at 5 B.H.P. at 760 r.p.m. and 440 volts. The design is such that, when required, a switch and trifurcating box, or a switch and a plug, or a trifurcating box only, may be fitted without any alteration

of the standard design. The machine shown is provided with a triple-pole, non-automatic, flameproof switch, and a Reyrolle flameproof plug for the incoming cable.

Besides other exhibits, J. and H. Holmes are showing some of their measuring instruments, including

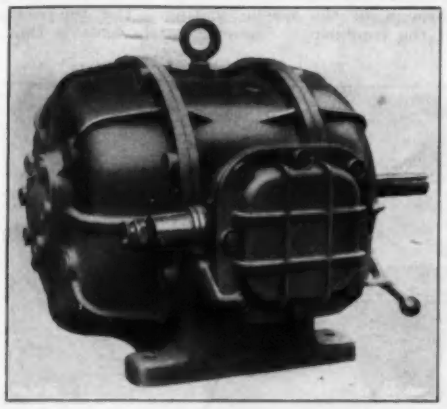


FIG. 17—FLAME-PROOF MOTOR—HOLMES

an 8in. dial voltmeter, a 7in. dial ammeter, an edgewise voltmeter, and a sector type wattmeter.

THE DOMINION MACHINERY COMPANY, LTD.

There are several wood-working machines on the stand of the Dominion Machinery Company, Ltd., Hipperholme, Halifax, among which we illustrate three examples in Figs. 18, 19 and 20.

The Super "Elliot" woodworker, shown in Figs. 18 and 19, is a universal type of machine, which can do practically any class of joinery work. It is driven by a 4 H.P. motor mounted on the top of a central standard, which has a long slideway at the top. The motor and the housing for a spindle, which it drives by means of a V belt, can be travelled along this slide, and the slide can be turned about the column to any angle. One end of the spindle is fitted with a circular saw, and the other end with a chuck to take boring tools. There is a table at a convenient height for the work—it is in the background in our illustrations—which works on slides. By a combination of the various movements, a very wide range of operations can be carried out. On the opposite side of the machine there is another table—in the front in Figs. 18 and 19—which is equipped with a horizontal spindle. This spindle is driven by a separate belt from the same motor, which is then clamped in place on the slide. It is used either as a saw spindle for ripping or to carry a cutter block for thicknessing, ploughing, &c. Timber up to 7in. thick can be ripped. It will be noticed that guards are arranged over the belt pulleys, but they can be easily swung out of the way when it is necessary to change the belts.

The spindle moulder and shaping machine illustrated in Fig. 20 has a rising and falling spindle operated by the hand wheel shown in the front. It runs in ball bearings and the slides are fitted with adjustable strips. The table is 32in. square and is reversible. It is fitted with loose rings, so that various sizes of cutters can be used, and has planed grooves for the fences. The fences are independent and have fine screw adjustments. They have front plates 6in. high.

STEWARTS AND LLOYDS, LTD.

Among the more interesting exhibits on the stand of Stewarts and Lloyds, Ltd., 41, Oswald-street, Glasgow, there is a series of sections of flanged joints for piping for steam pressures ranging up to 815 lb. per square inch, and the new loose flange joint illustrated by the sketch, Fig. 21. This joint scarcely needs any description, except to point out that its tightness depends upon the V welding, while its mechanical strength is ensured by the two collars bolted together over the swellings on the ends of the pipes. It will be noted that the bolts have screwed nuts on either end, so that they can be conveniently put in place in awkward corners, and that there is a ferrule inside the swelling of the joint which

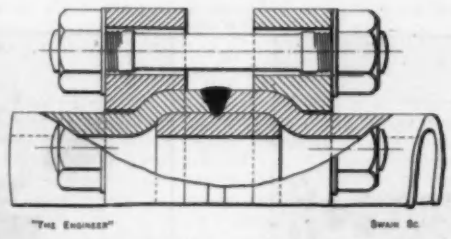


FIG. 21—STEAM PIPE JOINT—STEWARTS

makes the steam passage as fair as possible, while it also reinforces the welding. There is, of course, a large display of pipes and fittings on this stand, together with some examples of tubular steel pit props.

BRITISH INSULATED CABLES, LTD.

A selection of the latest types of butt, spot and seam welders is shown on the stand of British Insulated Cables, Ltd., of Prescot. The machine—shown in Fig. 23—is a butt welder for welding up to 2 square inch sections, and is suitable for welding flanges on to tubes, mild steel forgings on to tubes, and other sections. The machine consists of a standard transformer and clamping gear, but has special mechanism for welding. The parts to be welded are fixed in the machine by means of clamping gear, which may be either hand or power operated, the welding operation then being entirely automatic.

When the self-contained motor driving the upset gear has been set in motion, the slide is slightly withdrawn. The current is automatically switched on and the slide then moves slowly forward. When the parts to be welded make contact, the usual flashing takes place and is continued for a pre-determined time, allowing the two ends to become incandescent, ready for the final upsetting pressure, applied by means of a powerful spring, which is released after the flashing has taken place. After the metal has been upset the current is automatically switched off and the work is then ready for removing from the machine. The operating switch is then changed over, thereby causing the slide to be withdrawn to its original position. Two more pieces are then inserted in the machine and the switch once more changed over, and the cycle of operations is repeated. By means of this machine thousands of welds of the same character can be made and the correct upsetting pressure is applied in each case. The current is controlled by means of cams on the driving shaft, and when the machine has once been set no further adjustment is required when welding any particular class of material.

The machine shown in Fig. 24 is a seam welder, suitable for welding drum cylinders of No. 23 S.W.G., or less, and buckets, &c. The leading particulars are given below:

Capacity	15 kW
Number of heating speeds	8 to 10
Speed of welding	6ft. per minute
Size of driving pulley	15in. dia. by 2in. face
Speed of driving pulley	290 revs. per minute
Direction of rotation	Anti-clockwise
Overall dimensions of machine	34·5in. wide by 70·5in. deep by 61·5in. high
Height from ground to centre of driving pulley	46·5in.

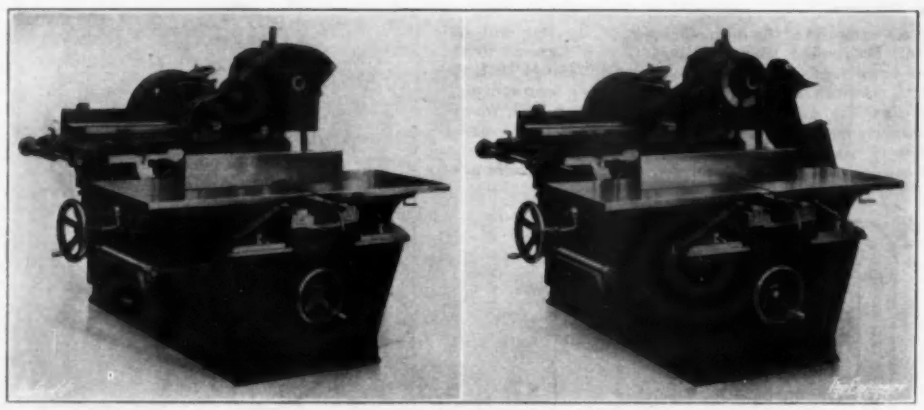
The machine consists of a 15 kW single-phase static transformer, enclosed in a cast iron case mounted on legs. The top electrode consists of a copper roller 7in. diameter by 1in. face, with a welding path about ¼in. wide. It is hinged on to a travelling carriage operated by a screw. The motion is transmitted from the driving pulley to the screw through a gear-box and reversible clutch, which is closed by a hand lever fitted on the front of the carriage rails and is opened automatically at each end of the travel. The bottom electrode is of the fixed rail type. In order to avoid spot welding the edges of the metal together, the cylinders may be clamped round the bottom stake, and a former to fit the inside of the body, and outside clamps are provided for this purpose. Back stops for location are also provided. To enable

FIG. 22—ELECTRIC WELDER FOR FINE WIRES—B.I.C.

the operator correctly to locate the right-hand edge of the body prior to clamping, a line is cut in the bottom electrode. The outside clamp is made in two or three sections, each with its own operating lever. One section takes care of the lower half of the body, whilst the remaining two hold the upper half, thus ensuring a constant overlap of the edges of the drum or cylinder. In certain cases the lower clamp is unnecessary. Mechanical pressure is applied to the weld by an adjustable compression spring, which is adjusted by means of a knurled nut. A hand wheel is provided to raise and lower the top electrode. Eight heating speeds are provided by means of a plug box. The electrical control gear consists of a single-pole, double-break A.C. contactor, which is automatically operated by a throw-over switch placed near the clutch control lever. Two regulating screws attached to the clutch operating rod are so adjusted that when the clutch is thrown in by the lever, the control switch automatically closes, and when the end of the weld is reached, it is opened by the motion of the rod, which releases the clutch. Both electrodes are arranged for water cooling.

The machine shown in Fig. 22 is suitable for welding small copper wires down to 0·0124in. in diameter, corresponding to No. 30 S.W.G.

The wires are clamped in the machine in the usual manner, after which the swinging arm is released. The current is applied by a small switch lever, and the weld is then automatically made. The machine consists of a small single-phase transformer, the primary being wound for any of the usual supply voltages. At the back of the machine there is a plug and flexible cord for connecting the machine to the supply circuit; whilst on the front of the machine there is a regulating switch, which is capable



FIGS. 18 AND 19—UNIVERSAL WOOD-WORKING MACHINE—DOMINION

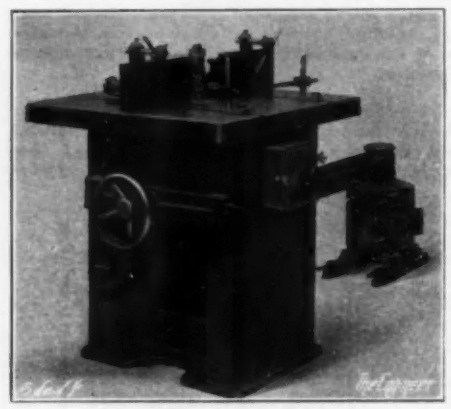


FIG. 20—MOULDING MACHINE—DOMINION

of opening the circuit and of regulating the machine for fast, medium and slow speeds. The clamp on the left-hand side of the machine is fixed to the base, whilst that on the right is mounted on a swinging arm, which is held in the open position by means of a small lever, capable of adjustment by means of a screw, and the movement of this screw in either direction opens or closes the gap between the two clamps. On the top of the machine, there is a small double-acting operating switch, the circuit being

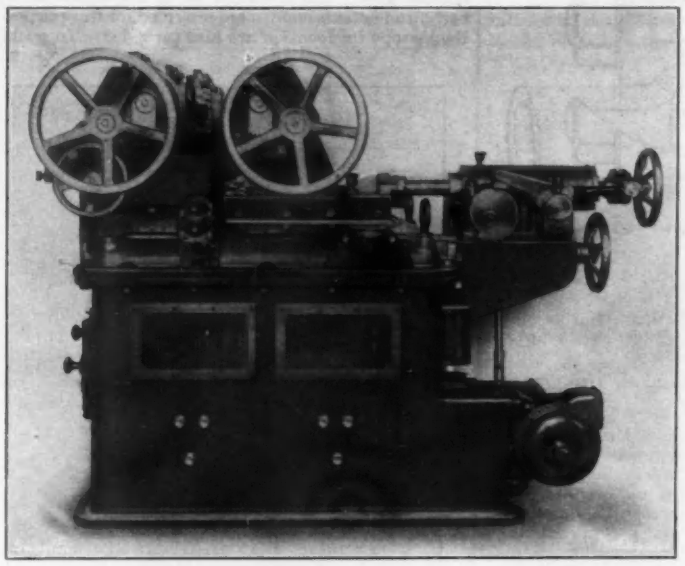


FIG. 23—AUTOMATIC BUTT WELDER—BRITISH INSULATED

closed by hand and opened by means of a knock-off rod attached to the swinging arm.

The gap of the machine is adjusted to correspond with the diameter of the wire, as shown in the following table :—

Diameter of Cu wire.	Gap.	Spring pressure.	Stop.	Ampères.
in.	in.	in.		
0·010	$\frac{1}{8}$	$\frac{1}{8}$	3	0·2
0·014	$\frac{1}{8}$	$\frac{1}{8}$	3	0·4
0·016	$\frac{5}{32}$	Full	3	0·6
0·018	$\frac{5}{32}$	,,	3	0·6
0·022	$\frac{1}{4}$	,,	2	0·8
0·024	$\frac{1}{4}$	,,	2	1·4

After the wires have been clamped in the machine with their ends abutting, the knock-off switch is adjusted so that the end of the rod practically touches the switch. The maximum consumption of current is 750 watts. Among other exhibits on this firm's stand are some new underground cable boxes, including network and service boxes, the latest type of Prescot feeder pillar, covered wires, meters, cut-outs, &c.

LUCAS FURNACES, LTD.

On the stand of Lucas Furnaces, Ltd., 53, Broad-street Birmingham, there is a high-speed steel heat-treatment furnace, fired by gas, the general arrangement of which is illustrated by the drawing, Fig. 25. It is claimed for these furnaces that there will not be a variation in temperature of 10 deg., plus or minus, over the whole area of the hearth right up to the door, even in a furnace as big as 5ft. 6in. by 20ft., a condition which is secured by efficient recuperation and insulation.

If the cross section of the furnace is studied, it will be noted that the products of combustion enter on both sides of the heating chamber and then pass through its full length to the front, where the waste gases pass over the front edge to the recuperators. This creates a gas screen at the front of the chamber, controlled by a damper sill, which enables operations to be carried out under open door conditions without affecting the atmosphere and even heat of the chamber. The recuperator chambers are continuous throughout the full length of the furnace and are of metal on account of its increased thermal conductivity over fire-brick. The waste gases enter the recuperators at practically the same temperature as that of the furnace. The secondary air enters at the sides of the furnace walls through regulated ports immediately below each burner, and is induced around the recuperators before meeting the fuel gases. The waste heat is thus efficiently utilised for heating the secondary air for supporting and intensifying combustion, the air being heated to practically the combustion point of carbon, which gives a spontaneous mixing and prevents free oxygen from coming in contact with the work. On leaving the recuperators the waste gases pass into a main flue and stack of sufficient height to pull them into the recuperators at the front downtake. The stack is provided with a damper for regulation according to the working temperature of the furnace. A balance of pressure is maintained when the correct temperature is obtained.

An example of the high efficiency of the recuperators may be judged from the fact that a furnace fired on town's gas of a calorific value of 480 B.Th.U's, with natural draught, having a working temperature of 1000 deg. Cent. in the heating chamber, will, when properly adjusted, allow of the hand being held immediately over the short main flue without discomfort. Heat losses by radiation from the outside walls are reduced to a minimum by efficient insulation. Special insulating bricks are built in the side and back walls between the fire-brick and the casing, while the arch is well covered with asbestos. The furnace doors are operated on the counterbalanced principle, and are actuated by a continuous chain. The casings are built on a patented system which dispenses with the rigidly bolted-up form of construction and allows for ample latitude for expansion and contraction.

Oil firing necessitates a larger combustion chamber than in gas-fired furnaces and hot primary and secondary air is used, at a constant pressure of about 1 lb. per square inch at the burners and air ports. The Lucas burner is supplied with its own filter as an extra precaution that no foreign matter can get through to the needle seating. The temperature of the combustion chamber barely exceeds that of the heating chamber, which has the great advantage of ensuring long life to the brickwork.

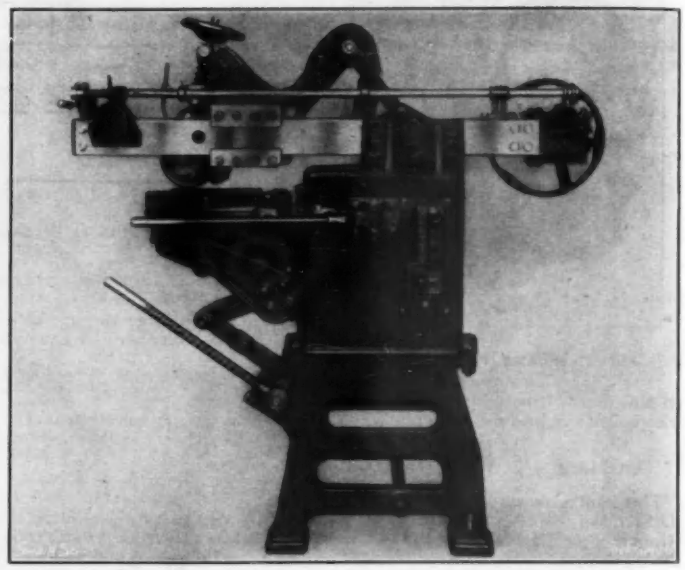


FIG. 24—SEAM WELDER—BRITISH INSULATED

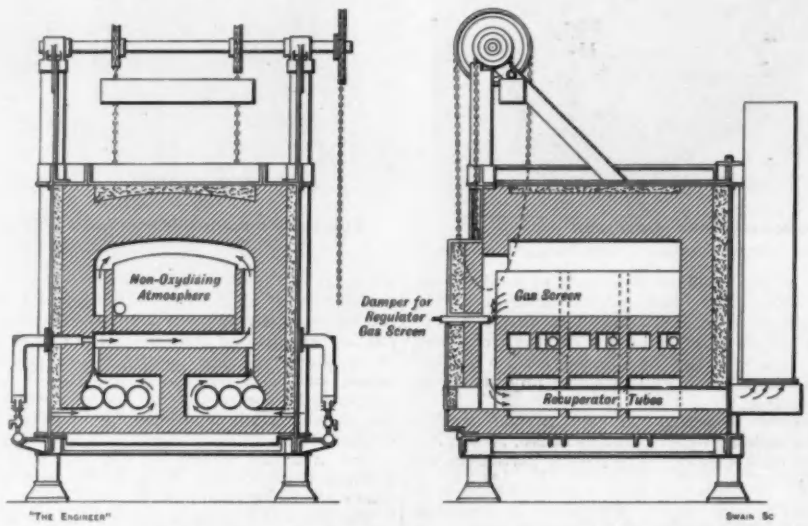


FIG. 25—GAS-HEATED RECUPERATING FURNACE—LUCAS

THE VILLIERS ENGINEERING COMPANY, LTD.

Among the smaller oil engine exhibits we may single out for mention that of the Villiers Engineering Company, Ltd., of Wolverhampton, which firm is showing examples of its air-cooled, tank, and hopper-cooled engines, with designed outputs ranging from 1½ to 3½ B.H.P. As an illustration of the latter type of engine, we have chosen the 3½ B.H.P. model, shown in Fig. 26. It has a bore of 79 mm. and a stroke of 70 mm., with a 342 cubic centimetre capacity, and develops its output at about 1000 r.p.m. A feature of the engine, as our engraving shows, is the cast aluminium fan and cowl on the auxiliary fly-wheel side, the purpose of which is to deliver cool air to the fins which surround the cylinder. The position of the sparking plug is so determined that pre-ignition is avoided and cool running is obtained. One of the firm's special carburetters is used in combination with an air cleaner, while the magneto is of the makers' fly-wheel type, enclosed in a water-tight cover. Lubrication is effected by the petroil system, the necessary lubricating oil being added to the fuel in the tank. A consumption of about 1·3 pint of petrol per B.H.P. hour is obtained with a lubricating oil consumption of about 0·04 pint per B.H.P. hour.

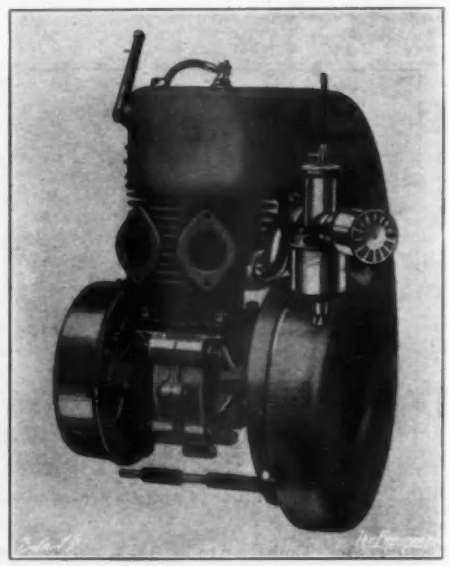


FIG. 26—3½ H.P. OIL ENGINE—VILLIERS

Our second engraving, Fig. 27, shows a 1·3 horse-power, 67 mm. bore, 70 mm. stroke, 247 cc. capacity Villiers engine, running at 1000 r.p.m., coupled direct to a small lighting and power set, with an output of 800 watts. These sets, which are supplied by

the firm of Russell, Newbery and Co., of Altrincham, near Manchester, can be arranged for either a 32 or 50-volt battery charging service, or 110-volt supply. The enclosed switchboard panel, which will be seen to the left of our engraving, enables the set to be started from the battery, and put on to battery charging. Supply can be obtained either from the dynamo or the battery, and provision is made for voltage regulation. As the engraving further shows,

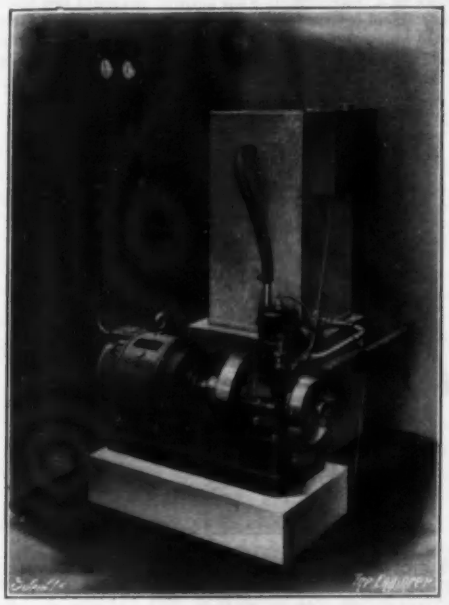


FIG. 27—1·3 H.P. LIGHTING SET—RUSSELL

the installation includes cooling water and fuel tanks, with auxiliary equipment.

W. C. HOLMES AND CO., LTD.

In the gas engineering section of the Fair there is the stand of W. C. Holmes and Co., Ltd., of Huddersfield, on which there are examples of the Holmes-Connersville blowers and exhausters, one of which is illustrated in Fig. 28. These machines are of the rotary type and are intended for services in which a positive delivery pressure of up to 10 lb. or 12 lb. per square inch is required.

The machine is of the Roots blower type and is capable of delivering 4,000,000 cubic feet of gas a day, as measured at the inlet, against a pressure

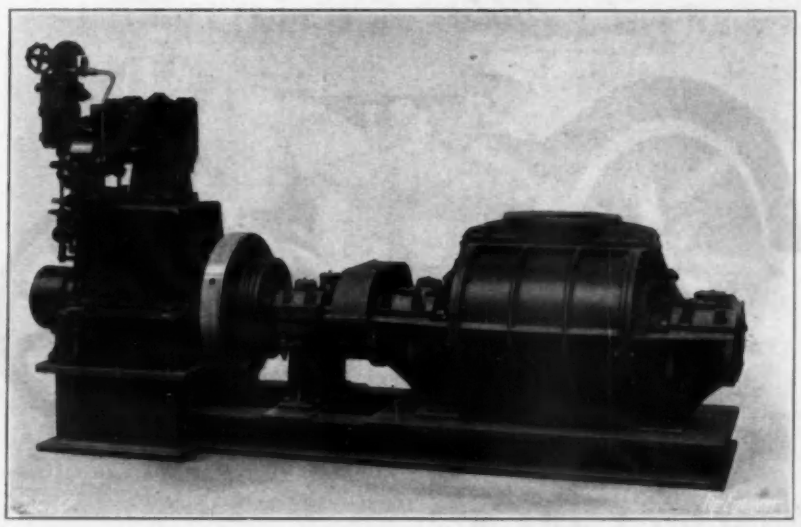


FIG. 28—STEAM-DRIVEN ROTARY GAS BLOWER—HOLMES

difference of 56in. water gauge. It runs at 326 revolutions per minute and is driven by a 30 horse-power Robey vertical steam engine. The impellers, of the familiar bulbous form, developed from involute curves, do not actually touch one another or the casing, so that there is no internal friction or wear. The clearance is, however, extremely small. It is, naturally, necessary in the circumstances to assure the continued alignment of the impeller shafts, and they are provided with ample bearings. In the case under review they are 3¼in. diameter by 9¼in. long, while the outside bearings are 3¼in. by 6¼in. These bearings are of the ring oiling type and have babbitt-lined sleeves, which can be renewed without disturbing the shafts. The stuffing-boxes are arranged on the inlet side of the machine, so that it can be worked against a delivery pressure without any fear of the escape of gas. A circular groove is also machined round the shaft on the end of the impeller and communicates with a slot in the end plate to lead back to the suction any gas which may leak past the end of the impeller. The gear wheels which interconnect the two impeller shafts are cut from semi-steel with epicycloidal teeth. These gears are designed to carry the full load on a single tooth with a good margin of safety, but actually two or three teeth are always in engagement. The wheels are of 16in. pitch diameter by 6in. face. The impellers are pressed on to their shafts and after assembly are given at least three finishing cuts in the lathe.

A. REYROLLE AND CO., LTD.

In co-operation with G. N. Haden and Sons, of Manchester, and by the courtesy of the Birmingham Corporation Electric Supply Department, A. Reyrolle and Co., Ltd., have installed a model heating scheme on the Corporation's stand. The equipment consists of a heater-tank, a storage cylinder, pipe work and radiators, and a control panel. The heater-tank is provided with a 15 kW bank of tubular immersion-

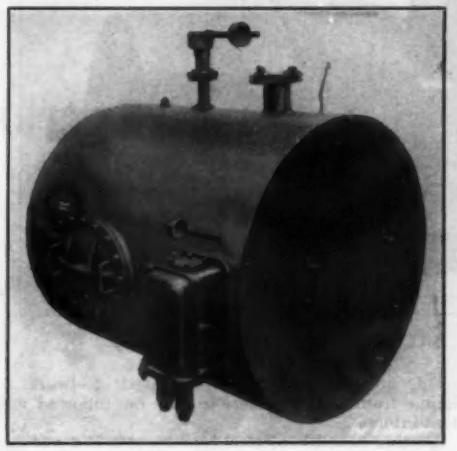


FIG. 29—ELECTRIC WATER HEATER—REYROLLE

type heaters connected to the three-phase, 440-volt, 25-cycle Exhibition supply. The storage cylinder has a capacity of approximately 700 gallons, and is fitted with a thermostat which operates in conjunction with a contactor switch which switches the supply of current on and off automatically, and thus maintains the water at a constant temperature. The heater and storage cylinders are efficiently lagged with Newall's 85 per cent. magnesia plastic lagging. Owing to tariff conditions, it is often necessary to use the heater at certain periods during the day, and in such cases a time switch is incorporated and adjusted to operate the heater automatically, to comply with the tariff conditions in vogue. In this particular installation a Venner time switch is mounted on the control panel. The illustrations Figs. 29 and 30 show an equipment designed for a 300 kW loading.

Another exhibit on this firm's stand is a centrovisory control equipment, for the centralised control of large power schemes, which provides a control engineer with a means of remotely controlling the complete network in his area. The equipment comprises a control panel, which, in practice, is placed at a central control point, and a "controlled" panel, situated at the controlled point. The panels are interconnected through pilots, the number of pilots depending upon the services required between the two points. The principle employed eliminates multitudinous relays and contacts, and substitutes for them robust and simple mechanism. The basic feature of the equipment is the rotation of two contact-making drums, which ensure step-by-step synchronism by positive interlocking in a definite electrical sequence. Each drum is fitted with a pointer, which moves over the face of the panel. A selector push-button enables the drum to be rotated to any desired position, and other pushes are provided for the operation of the unit indicated by the pointer.

FIG. 30—HEATING ELEMENTS—REYROLLE

At the central point, one panel or cubicle is required for each controlled point, and all operations, such as switching, paralleling machines—involving automatic synchronising—and transformer tap-changing, at the remote point, are controlled from this panel. Remote metering and telephonic communication may also be provided for. On the face of the control panel—see Fig. 31—there is a circular illuminated diagram, on which indications are given of each

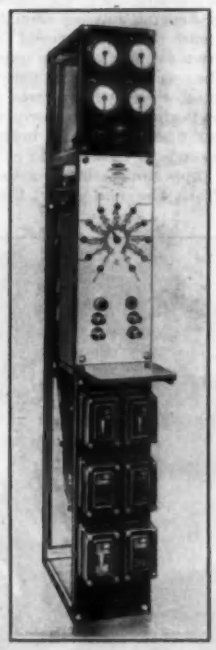


FIG. 31—CENTROVISOR—REYROLLE

operation, and of the condition of the apparatus operated.

DAVEY, PAXMAN AND CO., LTD.

A noteworthy exhibit on the stand of Davey, Paxman and Co., Ltd., of Colchester, and Aldwych House, London, W.C. 2, is the new totally-enclosed heavy-duty oil engine which we illustrate by Fig. 32. It is a six-cylinder model and represents one of a series of engines with three to eight cylinders, and with powers up to 400 B.H.P., all of which are designed to run at 600 r.p.m. The engine we show in engravings Figs. 32 and 33 has a designed output of 300 B.H.P. at 600 r.p.m., with a cylinder bore of 9in. and a stroke of 12in. It is direct coupled to a 200-kW D.C. generator supplied by the Metropolitan-Vickers Electrical Company, Ltd., and the engine and generator are mounted on one bed-plate, so as to form a very compact and neat unit. In designing this new engine the makers had in mind an engine which, while it would be available for the heaviest duties, would be accessible as regards its working parts, and would require only a minimum amount of attention and upkeep. Although a very compact and small engine, for its power, has been produced, there has, we are given to understand, been no attempt to cut down scantlings or to sacrifice the strength and the long life of the running parts. As our illustrations

show, the crank shaft is carried in a single casting bed-plate, to which is attached by studs the monoblock crank case and column casting on to which the cylinder heads are bolted, making ground joints with the cylinder liners. The combustion stresses are transmitted to the bed-plate casting by long tension bolts, which pass from the cylinder block through to the lower part of the bed-plate, thereby relieving the main framing of all tension stresses.

An interesting feature of the new design is the way

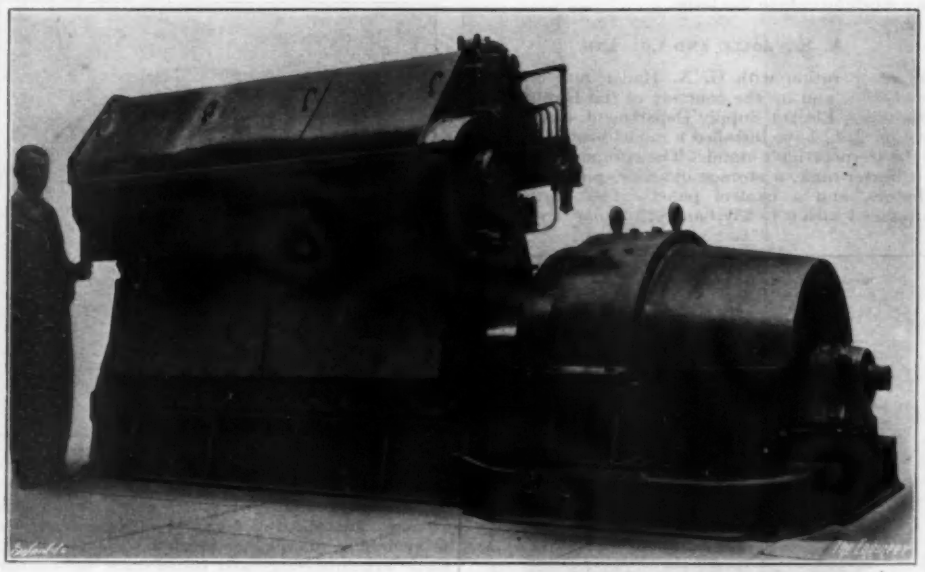


FIG. 32—300 B.H.P. SIX-CYLINDER OIL ENGINE—DAVEY PAXMAN

in which the pistons can be withdrawn through the crank case inspection doors. All that it is necessary to do is to remove the atomiser and to screw into the top of the piston the long sling bolt shown in Fig. 35. The bottom end bearing having been taken out, the piston and rod can then be lowered into the crank pit, and withdrawn sideways in the manner indicated in Fig. 35. The weight of the piston and rod is taken by a special slide, which rests on the crank. The operation is performed, we learn, with the same ease as a similar operation on a horizontal engine, and it is unnecessary to remove the cylinder head or to disturb any pipe connections or valve gear. As may be noted from the end view, Fig. 33, the cam

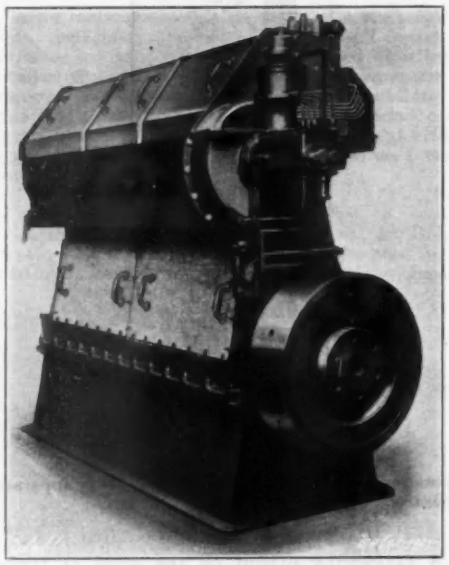


FIG. 33—SIX-CYLINDER OIL ENGINE—DAVEY PAXMAN

shaft, which is chain driven from the crank shaft, is totally enclosed. The valve gear is similar to that of the standard Paxman oil engine, and it incorporates the patented spring injection system. The cams run in an oil bath, and the valve gear is fitted with pressure lubrication. A sliding cover protects the various parts from dust and dirt. The governor is designed for close speed regulation, and in the six and eight-cylinder engines an arrangement for automatic starting by means of a special relay gear can also be added. This device enables the engine to be started up, and put into operation, immediately the current supply fails on the main supply line. With this attachment the engine forms an excellent emergency or standby set for power and lighting services.

With a view to meeting the peculiar requirements of engines designed for road transport or for special duties, in which they are exposed to severe and continuous vibration, a patented fabricated steel construction has been evolved for the engine framing, a section of which is exhibited on the firm's stand. Under the Stevens patents, a light and rigid framework can be fabricated from steel plates in such a way that the combustion and working stresses are taken by continuous steel slings arranged between the main bearings and cylinder heads in such a way that the cylinder heads themselves are not stressed.

This new application of fabricated steelwork for engine framing construction will be followed with close interest.

Another example of steel construction is a sectional hot-water boiler. It is built up on the multiple-unit system, each section being entirely self-contained, with no intermediate water joints with possible leaks between them. The front and back sections of the boiler are water encased, and with a double-return flue the gases are made to pass along the length of the boiler three times. No tubes are employed and all the surfaces are straight and flat, so that they can be swept right through from the doors which are provided at either end of the boiler. The design is

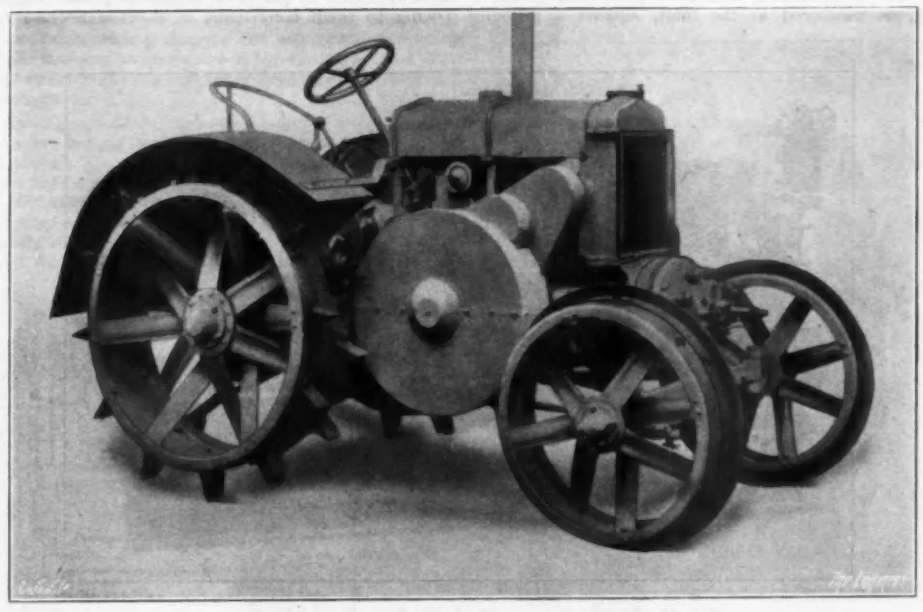


FIG. 34—HEAVY OIL TRACTOR—MARSHALL

one, the makers claim, which effects a considerable saving in the amount of fuel used. The boilers we have referred to are manufactured in three different types for central heating with hot water, low-pressure steam, and for hot water supply for domestic and other purposes.

MARSHALL, SONS AND CO., LTD.

With the exception of a single example of the Marshall industrial type oil engine, the whole of the exhibits on the stand of Marshall, Sons and Co., Ltd., of Gainsborough, comprise the latest type of the firm's oil engine-driven tractors, arranged for ploughing and power farming, or for road transport. A typical tractor of the type exhibited is illustrated in Fig. 34. The engine, which is of the firm's standard two-stroke, single-cylinder type, is arranged horizontally in the frame of the tractor in such a manner as to give easy access to the cylinder head. It is of the cold-starting type, and has a designed output on the belt of 27 B.H.P., with a maximum output of 30 B.H.P. It has a bore of 8in. with a stroke of 10½in., and the engine speed is 550 r.p.m. There is a cone clutch with totally enclosed hardened alloy steel gears running in an oil bath. Three speeds forward, namely, 2, 3·25 and 5 miles per hour, are available, with a single reverse speed of 2·5 miles

FIG. 35—REMOVING PISTON—DAVEY PAXMAN

per hour. The draw-bar pull is about 3500 lb. when ploughing in low gear, and the draw-bar arrangements are such that a vertical adjustment of 15in. and a horizontal adjustment of 27in. is possible. The tractor weighs approximately 2 tons 17 cwt. The front wheels are 2ft. 9in. in diameter, with a width of 7in., and the rear wheels have a diameter of 3ft. 10½in., with a 12in. width. The principal dimensions of the machine are: Overall length, 10ft. 3in.; overall width, 5ft. 9in., and height, 5ft. 7½in., with a turning radius of 13ft. For belt driving a 26½in. diameter pulley with a 7in. face, running at engine speed, is provided. When arranged for industrial purposes the forward speeds are 3, 5·25 and 8·75 miles per hour, with 3·75 miles per hour in the reverse speed. The tractor carries about 12 gallons of fuel and the consumption of the engine is about 0·48 lb. per B.H.P. hour.

The industrial type oil engine previously referred to is a representative example of the firm's cold-starting, four-cycle type engine, which has already been described in our pages. The present range of engine in course of manufacture includes eight single-cylinder models, with outputs varying from 16½ to 80 B.H.P., and three twin-cylinder engines with outputs from 110 to 160 B.H.P. The fuel consumptions vary from 0·48 lb. per B.H.P. hour for the smaller engines down to 0·38 lb. per B.H.P. hour for the larger sizes.

The Engineer

ESTABLISHED 1856.

28, ESSEX ST., STRAND, LONDON, W.C. 2.

BRITISH EMPIRE TRADE EXHIBITION, BUENOS AIRES.

View of Exhibition Buildings.

ANGLO-SPANISH SUPPLEMENT

to THE ENGINEER,

MARCH 13, 1931.

The Buenos Aires Trade Exhibition, 1931.

British Empire Trade Exhibition, Buenos Aires, 1931.

MANY statements have been made during the last few years that British salesmanship is not as good as that of other countries, and that British firms are lacking in initiative and are inattentive to detail in the effort to gain new or retain old markets. The excellent response of British engineering firms to the invitation of the Department of Overseas Trade to participate in the Exhibition at Buenos Aires, initiated by the British Chamber of Commerce of that city, is a sufficient answer to any charge of lack of initiative, while we ourselves can state that as far as attention to detail is concerned, many firms have gone to considerable trouble to make their goods acceptable to the peoples of South America. A number of firms have asked us to point out that all their catalogues have been printed in Spanish as well as English, and some of them have issued pamphlets in Spanish describing the exhibits which they are sending to Buenos Aires. The efforts of the salesmen on the various stands on the spot, we feel sure, will refute the suggestion that British salesmanship lacks life. It is particularly noticeable to us on this occasion that exhibitors are eager to have their products described; so much is this the case that we cannot within the limited space enclosed in the covers of this Supplement deal with more than a very small proportion of the number of interesting machines on view. In the circumstances, we have endeavoured as far as possible to indicate the great range of articles that are to be seen. In later issues of the paper itself we hope to deal with the products of other manufacturers, space for which could not be found in the pages of this Supplement.

HAN sido muchas las manifestaciones hechas durante los últimos años de que las formas en que son vendidos los artículos ingleses no son tan buenas como las de los otros países y que a las firmas inglesas les falta iniciativa y no se preocupan de detalles en el esfuerzo de ganar nuevos mercados o de conservar los antiguos. La respuesta excelente de las firmas de ingeniería británicas a la invitación del Departmento de Comercio Exterior para participar en la Exposición de Buenos Aires, iniciada por la Cámara de Comercio Británica de dicha ciudad, es una contestación suficiente a cualquier carga de falta de iniciativa, mientras que nosotros podemos asegurar que por lo que respecta a detalles, muchas firmas se han tomado muchísimas molestias para poner sus productos en forma adaptable a los gustos y necesidades de los pueblos de la América del Sur. Varias firmas nos han pedido que hagamos público que todos sus catálogos han sido impresos en español y en inglés y algunas firmas han publicado folletos en español describiendo los productos que envian para ser expuestos en dicha Exposición. Los esfuerzos de los vendedores en los diferentes stands de la Exposición, demostrarán lo erróneo de la idea de que al vendedor inglés le falta actividad. Algo que hemos podido notar particularmente en esta ocasión, ha sido que los expositores han mostrado grandes deseos de que sus productos sean descritos; tanto es asi que nos es solamente posible el dar a conocer algunos de ellos, y una parte muy pequeña del gran número de máquinas interesantísimas expuestas, debido al limitado espacio de que disponemos en este Suplemento. Debido a esta razón, hemos procurado, en cuanto nos ha sido posible, indicar la gran variedad de artículos que serán expuestos. En ediciones siguientes de nuestro periódico confiamos en que podremos tratar de los productos de otros fabricantes, para lo cual no nos ha sido posible encontrar espacio en este Suplemento.

H. W. KEARNS AND CO., LTD.

H. W. Kearns and Co., Ltd., of Broadheath, Manchester, are exhibiting one of their No. 2 size "Kearns Patent" surfacing, boring, milling, drilling and tapping machines. The photograph reproduced in Fig. 1 shows very clearly the construction of this machine, which has a number of interesting and useful features. The most important of these is the combination of a travelling spindle of a substantial diameter with a self-contained automatic facing chuck, thus enabling boring and facing to be carried on simultaneously. Radial motion is imparted to the facing slide by means of a scroll plate carried at the back of the chuck. The makers claim that this method of drive has many advantages over screw or rack mechanisms, involving as it does few working parts and enabling the facing chuck to be carried very close to the front bearing. Automatic feed can be obtained in either direction from the main feed box and a large range is available. The travelling spindle can be revolved simultaneously with the facing chuck or independently. It is driven by the Kearns system, in which a direct belt drive is used for high, while a drive through spur gearing is used for slow speeds. The spindle is arranged to give automatic feed in either direction. The controls of the machine are grouped together in a position convenient for the operator, as can be seen at once from a glance at the illustration. Simplification of working has been achieved by making single levers perform a number of operations. For instance, the vertical traverse of the spindle slide and the longitudinal and transverse motions of the table are controlled by one lever only. Rapid power traverse in either direction and the engagement of the automatic feeds are controlled by a single lever. By this arrangement of levers the operator cannot engage conflicting motions. The T slots on the table are accurately machined, so that interchangeable jigs may be used. The turntable can be rapidly released and re-locked in any of its rectangular positions, without special adjustments, by operating a small pinion which moves two H-shaped pieces, sections of which engage with slots cut on the under side of the table. The bed of the machine is strongly constructed of box section with a form of ribbing which, according to the makers, gives a much greater strength than the usual cross-ribbed type. It is fitted with cutting shoots to carry the cuttings clear and the sliding ways are protected by guards. The screw and shaft are also protected by a box form guard.

The machine can be driven by belt or electric motor, and the electric drive can easily be fitted at a later date if desired. The drive is taken through a clutch to the gears in a detachable gear-box. The gears themselves are of nickel steel and run in oil. A single lever controls them, and gear-changing is accomplished by the use of this lever and that for the clutch. The feed box is situated on the spindle slide; it gives eight speeds of feed, all of which are reversible. The driving and feed gears throughout are of nickel steel or phosphor bronze, except the large back shaft gears on the spindle slide. Running shafts and screws are of hard Bessemer steel.

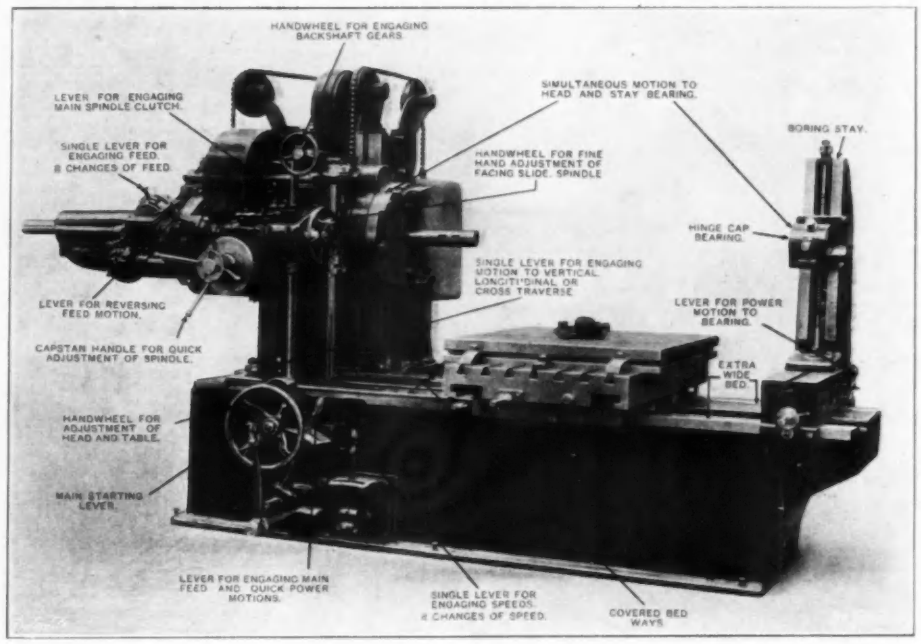

HANDWHEEL FOR ENGAGING BACKSHAFT GEARS.
LEVER FOR ENGAGING MAIN SPINDLE CLUTCH.
SIMULTANEOUS MOTION TO HEAD AND STAY BEARING.
BORING STAY.
SINGLE LEVER FOR ENGAGING FEED. 8 CHANGES OF FEED.
HANDWHEEL FOR FINE HAND ADJUSTMENT OF FACING SLIDE SPINDLE
HINGE CAP BEARING.
SINGLE LEVER FOR ENGAGING MOTION TO VERTICAL, LONGITUDINAL OR CROSS TRAVERSE
LEVER FOR REVERSING FEED MOTION.
LEVER FOR POWER MOTION TO BEARING.
CAPSTAN HANDLE FOR QUICK ADJUSTMENT OF SPINDLE.
EXTRA WIDE BED.
HANDWHEEL FOR ADJUSTMENT OF HEAD AND TABLE.
MAIN STARTING LEVER.
LEVER FOR ENGAGING MAIN FEED AND QUICK POWER MOTIONS.
SINGLE LEVER FOR ENGAGING SPEEDS. 8 CHANGES OF SPEED.
COVERED BED WAYS.

FIG. 1—SURFACING AND BORING MACHINE—KEARNS

Los Sres. H. W. Kearns y Cía., Ltda., de Broadheath, Manchester, exponen uno de los tipos de máquinas para planear, refrentar, agujerear, laminar, escariar y terrajar, tamaño No. 2 "Patente de Kearn." La fotografía reproducida en la Fig. 1 muestra muy claramente la construcción de esta máquina, la que posée un número de rasgos útiles e interesantes. El mas importante de estos es la combinación de un eje desplazable de gran diámetro con un mandril compacto automático de refrentar, el que permite perforar y planear simultáneamente. El movimiento radial de la corredera de planear se produce por medio de un mandril con sujeción de espiral plana en la parte de atrás. Los fabricantes dicen que este método de mandar tiene muchas ventajas sobre los sistemas de tornillo o cremallera, por tener menos partes movibles y por permitir acercar el mandril de refrentar muy cerca del cojinete del frente. Se puede obtener alimentación automática en cualquier dirección desde la caja de alimentación y se obtiene un amplio márgen. El husillo deslizable puede girar con el mandril o independientemente. Va mandado por el sistema Kearns, en el cual una correa se usa directamente para altas velocidades, mientras que para bajas se usa transmisión de engranages rectos. El husillo está arreglado para dar alimentación automática en cualquier dirección. Los controles de la máquina están agrupados juntos en una posición conveniente para el operario como se puede ver echando una mirada a la figura. Se ha obtenido simplificación de trabajo haciendo que palancas sencillas ejecuten un número de operaciones. Por ejemplo, el avance transversal vertical del husillo y cursor y los movimientos longitudinal y transversal de la mesa van controlados por una sola palanca. Los esfuerzos transversales rápidos en cualquier dirección y el embrague de las alimentaciones automáticas van manejadas por una sola palanca. Con este arreglo de palancas, el operario no puede embragar movimientos opuestos. Las ranuras en T de la mesa están perfectamente acabadas a máquina de modo que se pueda usar plantillas intercambiables. La placa o mesa giratoria puede aflojarse fácilmente y reajustarse en cualquiera de sus posiciones rectangulares, sin ajustes especiales, operando un pequeño piñón que mueve dos piezas en forma de H, cuyas secciones encajan en las muescas existentes en el lado

de abajo de la mesa. La base de la máquina está construida sólidamente en forma de puente o caja con unos refuerzos de tal forma que según los fabricantes, da mucha mas fuerza que el usual de nervaduras cruzadas. Está provisto de vertederas para descargar las torneaduras y los rieles de los cursores están protegidos por tapas. La rosca y los rieles de los cursores están protegidos por tapas. La rosca y el eje están también protegidos por una tapa en forma de caja. La máquina puede ser movida por correa o por motor eléctrico, y este puede adaptarse

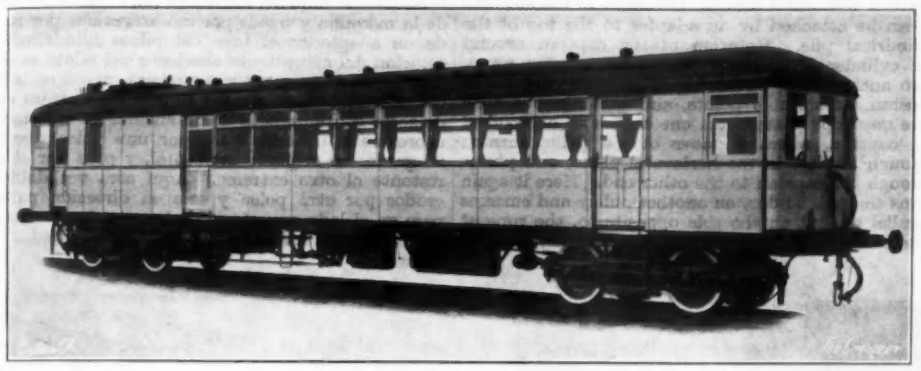


FIG. 2—STEAM RAIL CAR—SENTINEL - CAMMELL

después fácilmente si es necesario. La transmisión se toma del embrague a los engranages por intermedio de una caja de engranes de quita y pon. Los engranages son de acero nikel y trabajan en aceite. Una palanca sencilla los maneja, y el cambio de velocidades se efectúa por medio de esta palanca y la del embrague. La caja de alimentación está en el lado del cursor del husillo; permite ocho velocidades de alimentación, todas las cuales son reversibles. Los engranages de mando y de alimentación son todos de acero nikel o bronce fosforoso, excepto los engranages grandes del eje de atrás del lado del cursor del husillo. Los ejes móviles y los tornillos son de acero duro de Bessemer.

METROPOLITAN-CAMMELL.

On the stand of the Metropolitan Cammell Carriage, Wagon and Finance Company, Ltd., a model of a typical Sentinel Cammell steam rail car—see Fig. 2—makes a very interesting exhibit. This car is now becoming well known in England and abroad. The makers state that no less than 47 railways in 31 different countries are now using these coaches, the London and North-Eastern Railway, in England, alone having 77 of them in use for branch line traffic. In the type exhibited there is seating accommodation for fifty-six passengers and hand straps are fitted for the use of twenty more; there is also a large luggage compartment. The body is constructed of light steel, both the sides and roof of the car forming an integral part of the whole structure. Two sliding doors are fitted on each side, one giving access to the luggage compartment and the other to the main body of the car. Steam heating and efficient ventilation are provided, and the car is lighted by electricity.

The cars run on two bogies, the power being transmitted through one pair of wheels. The power unit has a designed output of about 130 B.H.P. at 500 revolutions per minute, but is fully capable of running at 750 revolutions per minute, corresponding to a speed of 50 miles per hour. The cylinders have a bore of 6in. with a stroke of 7in. and poppet type valves are employed. In this design there are three running positions—early, intermediate and late cut-off in either direction of rotation, and a central position in which all valves are held open. The engine is suspended beneath the coach well clear of the front bogie, and access to it can be gained by means of removable floor plates inside the coach, or from beneath by running the coach over a pit. The engine is firmly attached to the framework of the coach, and, as the boiler is attached in a similar manner, no flexible steam pipes are necessary.

The boiler is of the Super-Sentinel vertical, water-tube type, and is designed for a working pressure of 300 lb. per square inch, with a heating surface of 73 square feet and a grate area—for coal firing—of 5·1 square feet. The superheater gives a steam temperature of 650 deg. to 700 deg. Fah. By introducing an air casing over the boiler top and round the funnel, and by lagging all heated parts efficiently, a very cool driving compartment has been obtained, together with an increase in efficiency.

The car can be driven from either end, the controls from the rear compartment being connected up with the engine by means of stout rods. The cabs are very roomy and the windows are of ample dimensions and are fitted with mechanical screen wipers. A fully illustrated description of this vehicle may be found in THE ENGINEER of May 18th, 1928.

On the same stand there is shown a first-class steel saloon car, one of a number of such cars recently supplied by the Metropolitan Cammell Carriage, Wagon and Finance Company to the Central Argentine Railway—Fig. 3. This coach is 70ft. long from end to end of the body. The gauge is 5ft. 6in. and the distance between bogie centres is 56ft., while the maximum width is 10ft. 8½in. It seats 84 passengers.

Other items include a motor bogie similar to those supplied to the Ferrocaril Central Terminal de Buenos Aires for the underground service in that city, steel disc wagon wheels made by Taylor Brothers, Ltd., of Manchester, and rolling stock forgings and castings made by the English Steel Corporation. The office on the stand is built up on an actual section from one of the Grand Luxe sleeping cars supplied to the Cie. Internationale des Wagons-Lits.

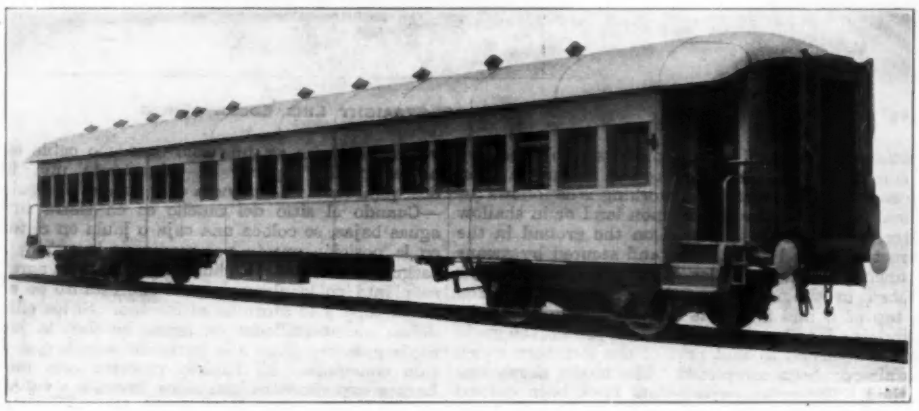


FIG. 3—FIRST CLASS SALOON CAR—METRO - CAMMELL

En el stand de la Metropolitan Cammell Carriage Wagon and Finance Company, Ltd., es de sumo interés el modelo que se expone de un típico automotriz a vapor "Sentinel-Cammell" (Fig. 2). Este automotriz se conoce cada vez mas tanto en Inglaterra como en el extranjero. Dicen los fabricantes que nada menos que 47 Compañías Ferroviarias en 31 paises distintos emplean estos coches, teniendo el London and North-Eastern Railway (el ferrocarril de Londres al Norte y al Este de Inglaterra) por sí solo 77 para el servicio de sus ramales. En los autos del tipo que se expone hay cabida para 56 pasajeros, con correas de mano para 20 más, habiendo tambien un espacioso compartimento-furgon para equipajes. La carroza está construida de acero ligero, formando los costados y el techo parte intégra del coche completo. El auto está provisto de dos portezuelas corredizas, una de las cuales sirve para el compartimento de los equipajes, y la otra para el interior del auto mismo. El coche tiene alumbrado eléctrico, habiendo a demás calefaccion a vapor, y ventilacion adecuada.

El auto va montado sobre dos (carretillas giratorias) "bogies" transmitiéndose la fuerza motriz por un par de ruedas. El motor está construido para dar un rendimiento de unos 130 caballos de fuerza al freno a 500 revoluciones por minuto, pero es facilmente capaz de dar 750 revoluciones por minuto, lo que corresponde a una marcha de 50 millas por hora [80 kilometros]. Los cilindros son de 6 pulgadas [15·24 cms.] de diámetro interno, siendo la carrera del émbolo de 7 pulgadas [17·78 cms.] empleándose válvulas de huso. En los motores de este tipo hay tres posiciones de marcha del corta-vapor, a saber, adelantada, intermedia y retardada, en ambos sentidos de rotacion, con además una posicion céntrica en la que todas las válvulas quedan abiertas. El motor queda colgado debajo del automotriz convenientemente alejado del bogie delantero, y se le tiene acceso mediante unas planchas de quita y pon en el piso del coche, o por debajo si se lleva el auto sobre un foso. El motor va firmemente asegurado al chassis del coche, y visto que la caldera va asegurado del mismo modo no es preciso dotarle de tubos de vapor flexibles.

La caldera es del tipo "Super-Sentinel" vertical, de tubos a agua y está construida para una presion de 300 lbs. por pulgada cuadrada [20 atmósferos] con una superficie de calefaccion de 6·78 metros [73 pies]

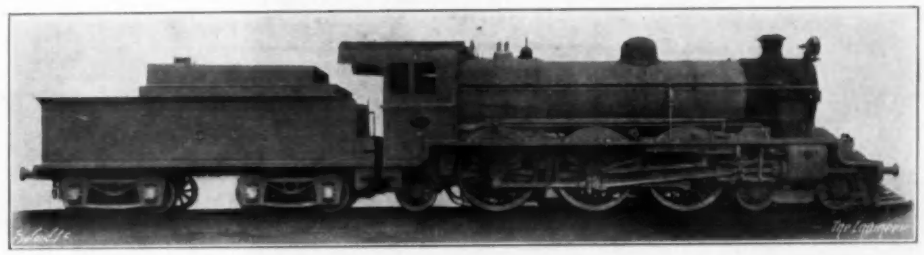


FIG. 4—EXPRESS LOCOMOTIVE—VULCAN

cuadrados, y una parrilla, para carbón, de 0·47 metros (5·1 pies) cuadrados. El sobrecalentador da al vapor una temperatura de 343–371 grados C. Dotándole a la caldera y a la chimenea de una camisa de aire, y revistiendo de un modo eficaz todas las partes calentadas, el compartimento del maquinista se conserva fresco, y el rendimiento del motor queda aumentado.

El automotriz puede conducirse de ambos extremos, quedando los aparatos de control del compartimento de atras, unidos al motor por medio de varillas gruesas. Los compartimentos del maquinista son espaciosos, las ventanillas de tamaño adecuado, quedando tambien provistas de limpiadoras de parabrisas antomáticas. Se hallará una descripcion ilustrada de este vehículo en la revista técnica EL ENGINEER del número del 18 de mayo de 1928.

En el mismo stand se tiene expuesto un coche salon de primera clase, fabricado de acero, que es uno de varios coches de este tipo suministrados ultimamente por la Metropolitan Cammell Carriage, Wagon and Finance Company al F. C. Central Argentino (Fig. 3). Este coche es de 21·33 metros [70 pies] de largo, de extremo a extremo de la carroza. La trocha es de 1·67 metros y la distancia entre los centros de los bogies es de 17·07 metros, siendo el ancho máximo de 3·25 m. Tiene el coche cabida para 84 pasajeros.

Otros artículos que se ven expuestos son una carretilla a motor parecida a las que se han suministrado a la estacion terminal del F. C. Central de Buenos Aires para el servicio subterráneo de aquella ciudad; ruedas de vagon a discos de acero, fabricadas por Taylor Brothers, Ltd., de Manchester (Inglaterra), y piezas fraguadas y fundidas para material rodante, hechas por la English Steel Corporation. El despacho del stand está construido con una verdadera seccion de uno de los coches-camas de gran lujo, suministrados a la Cia. Internacional de Coches-Camas.

VULCAN FOUNDRY, LTD.

A number of firms are exhibiting railway equipment of various descriptions ranging from rails and signals to rolling stock and locomotives. An exhibit of this nature which will attract considerable attention is a 4–6–2 locomotive which the Vulcan Foundry, Ltd., of Newton-le-Willows, Lancashire, built for the Buenos Ayres Great Southern Railway in 1926. It is one of an order received for twenty. The general

appearance of the locomotive can be seen from the photograph we reproduce in Fig. 4. Designed for fast passenger service, its main dimensions are:—Wheel base, engine and tender, 60ft. 3¾in.; wheel base, engine alone, 33ft. 6in.; weight of engine alone, 86·2 tons, and with tender, 148·6 tons. The weight on the driving wheels is 51·25 tons, and the tractive effort 30,685 lb. While the driving wheels have a diameter of 6ft. 6in., that of the bogies is 3ft. 2in. All three cylinders have the same diameter, 19in., and the pistons have a stroke of 26in. The boiler is 16ft. in length with an internal diameter of 5ft. 3⅛in., and is designed for a steam pressure of 200 lb. per square inch. The heating surface in the fire-box is 155 square feet. A large number of firms have supplied parts for this locomotive, which will be taken into service by the railway company as soon as the Exhibition is over.

Varias firmas tienen expuesto material ferroviario de todo género, desde rieles y señales hasta material rodante y locomotoras. Una instalación de esta clase que llamará mucho la atención es una locomotora de tipo 4–6–2 que la Vulcan Foundry, Ltd., de Newton-le-Willows, Lancashire, construyó para el F. C. del Sur de Buenos Aires en 1926. Esta es una de las 20 que fueron ordenadas. La apariencia general de la locomotora puede ser vista de la fotografía reproducida en las Fig. 4. Esta máquina está destinada para servicio rápido de pasajeros y sus dimensiones principales son las siguientes; distancia total entre ejes, locomotora y tender, 60 pies 3¾ pulg. [18·4 m.]; distancia entre ejes de la locomotora sola, 33 pies 6 pulg. [10·2 m.]; peso de la máquina sola, 86·2 Toneladas y con tender 148·6 Toneladas. El peso sobre las ruedas motrices es de 51·25 Toneladas y el esfuerzo util de tracción es de 30,685 lib. [13·7 ton]. Las ruedas motrices tienen un diámetro de 6 pies 6 pulg. [2 m.], y las del bogie de 3 pies 2 pulg. [·96 m.]. Todos los tres cilindros tienen el mismo diámetro de 19 pulg. [·48 m.] y los émbolos tienen una carrera de 26 pulg. [·67 m.]. La caldera tiene un largo de 16 pies, con un diámetro interno de 5 pies 3⅞ pulg. [1·6 m.] y está construida para una presión de vapor de 200 lib. p. pulg. cuad. [14·1 at.]. La superficie de calefacción del hogar es de 155 pies cuad. [14 m.²]. Son muchas las firmas que han suministrado partes para esta locomotora, que entrará en el servicio de la compañia ferroviaria tan pronto comose haya terminado la Exposición.

BRAITHWAITE AND CO.

A NUMBER of models illustrate very well the range of work which the firm of Braithwaite and Co., of London, is ready to handle. The standard practice of the firm with regard to the construction of steel jetties on screw cylinder foundations is the subject of an excellent and interesting model, which has been built to a scale one-twenty-fourth full size. This model—see Fig. 5—shows part of the steel work of a jetty already in place, and mounted upon it a crane running on tracks upon its surface. From the crane there is supported an electric screwing capstan for driving the piles into the sea bed. On the full-size capstan are mounted motors capable of driving piles 3ft. in diameter with a screw 7ft. in diameter. The capstan consists of a motor and a train of gear wheels mounted in a frame; the hub of the final gear wheel being at the centre of the machine it can be attached by an adapter to the top of the cylindrical pile. Rotation of the capstan around the cylinder is prevented by means of guy ropes. Two anchors are provided, one on each side of the capstan, at suitable points, and a continuous steel wire guy rope passes from one anchor to one end of the capstan, where it passes over a pulley turning through 90 deg. in the horizontal plane, and passes through the capstan to the other end. Here it again turns through 90 deg. on another pulley and emerges parallel to, but on the side opposite to, the rope at entry, and is continued to the other anchor, where it is attached. The advantage of thus using one guy rope is that no unbalanced force can be thrown upon the capstan. The method of working is as follows:—When the site of the pier is upon land or in shallow water, a guide cage is placed on the ground in the correct position by the crane and secured by means of anchors. The cylinder, with screw attached, is pitched in the opening and the capstan is fixed on top of it and screws it into the ground. If the cylinders are to be screwed into deep water, the guide cage is attached to that part of the structure which has already been completed. The model shows this method. Extensive experiments have been carried out to decide upon the best speeds at which to screw the piles. The power necessary has been found to be 30 H.P. for screws 10ft. in diameter and proportionately less for smaller screws.

Three other models are exhibited. One shows to one-eighth full scale the type of pressed steel tank made by the firm mounted on a steel tower, and another a one-eighth scale model of pressed steel lining for tunnels, sewers and shafts, while the third is a one-eighth scale model of a double circuit type transmission line tower, similar to those supplied to the Central Electricity Board in England.

Bastantes modelos muestran muy bién la variedad de trabajo que la firma Braithwaite y Cía., de Londres, es capaz de emprender. La práctica normal de la firma con respecto a la construcción de muelles, o malecones con pilares de cilindros roscados de acero para los cimientos va demostrada por un excelente e interesante modelo, ejecutado en escala 1/24 del tamaño natural. Este modelo, vea Fig. 5, muestra parte del trabajo de acero de un rompeolas en su lugar definitivo, y sobre él una grúa sobre rieles colocados en su parte superior. De la grúa cuelga un cabrestante eléctrico para hundir los pilotes en el fondo del mar. En el cabrestante real hay fijos motores capaces de hundir pilotes de 3′ de diámetro con una rosca de 7′ de diámetro. El cabrestante es un motor y un juego de engranajes montados en un bastidor; el buje del engranaje final está en el centro de la máquina y puede por eso asegurarse por medio de un adaptador al tope del pilote cilíndrico. La rotación del cabrestante alrededor del pilote se evita por medio de tensores. Dos anclas, una a cada lado del cabrestante, en puntos convenientes, y un cable de acero contínuo pasa de un ancla a un extremo del cabrestante, endonde pasa por una polea que gira 90 grados en el plano horizontal, y pasa por el cabrestante al otro extremo. Aquí otra vez dobla 90 grados por otra polea y sale en dirección paralela pero en el lado opuesto al de la entrada, y continúa hasta la otra ancla, donde queda asegurada. La ventaja de usar así una sola cuerda o cable es que no es posible aplicar al cabrestante una fuerza desequilibrada. La manera de operar es la siguiente:—Cuando el sitio del muelle es en tierra firme o aguas bajas, se coloca una caja o jaula en el terreno en la posición exacta por medio de la grúa y se la asegura con anclas. El cilindro con la rosca agregada, se planta en la abertura y el cabrestante se afirma en su tope y lo atornilla al terreno. Si los cilindros deben ser atornillados en aguas hondas, la jaula o cajón guía se agrega a la parte del muelle que ya ha sido concluida. El modelo muestra este método. Largos experimentos han sidos llevados a cabo para decidir cuales eran las velocidades mas útiles de atornillar estos pilotes. La energía necesaria se ha visto que es 30 H.P. para roscas de 10′ de diámetro y proporcionalmente menores para roscas mas pequeñas.

Se expone también otros tres modelos. Uno muestra en escala de 1/8 del tamaño natural el tipo de tanque de acero prensado hecho por la firma montado en una torre de acero, y otro un modelo a 1/8 de forros para túneles de acero prensado, o para cloacas o pozos de mina, entanto que el tercero es un modelo a 1/8 de una torre de transmisión de línea de doble circuito, semejante a las suministradas al Central Electricity Board en Inglaterra.

LOUDON BROS., LTD.

Loudon Bros., Ltd., London, are the South American agents for a number of English machine

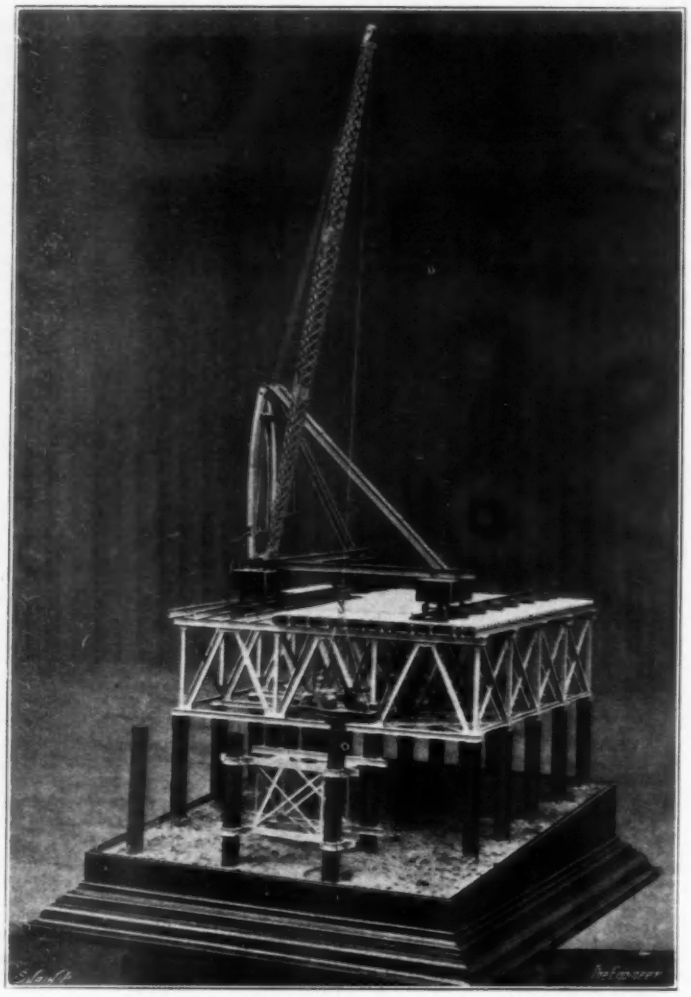


FIG. 5—PILE DRIVING MODEL—BRAITHWAITE

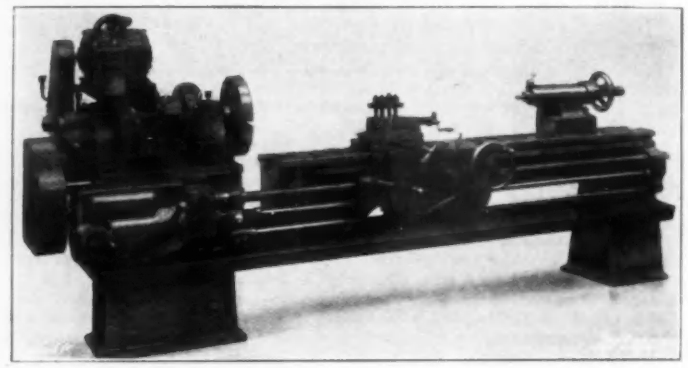


FIG. 6—LATHE—GRAHAM

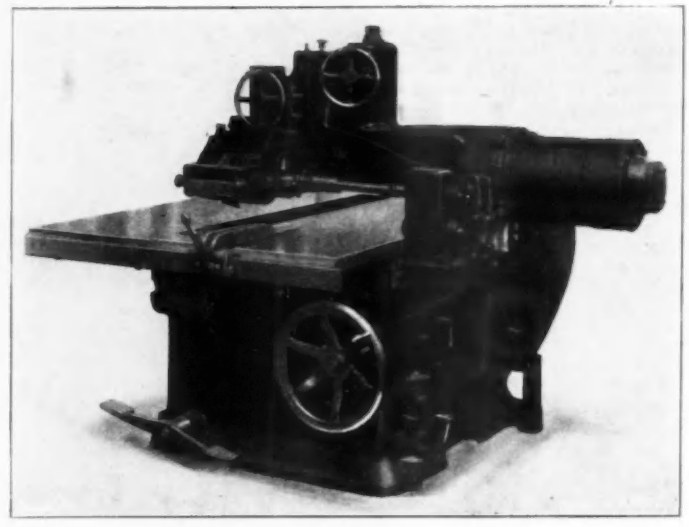


FIG. 7—STRAIGHT LINE EDGER—WHITE

tool and woodworking machine makers, and there is a large variety of such machines on their stand, whilst they themselves are showing a horizontal metal planing machine, electrically driven, capable of giving a range of cutting speeds from 37½ft. to 375ft. per minute with return speeds up to 375ft. per minute. All motions are controlled by push-buttons. There is also exhibited a metal-cutting saw by the same makers.

A 3 cwt. motor-driven pneumatic power hammer, constructed by R. G. Ross and Son, Ltd., Glasgow, and shown on this stand, is capable of delivering 150 blows a minute. It is arranged so that it may be controlled either by hand or by means of a foot pedal. It is claimed by the makers that the two-valve system embodied in it gives the hammer a considerable superiority as regards control and the power of the blow. The valves are of large diameter and are connected with the cylinder by short wide passages, thus ensuring easy unrestricted movement between the compressor and the cylinders of the hammer. The clearance spaces in the compressor cylinders have been reduced to a minimum to ensure the highest possible working air pressure on top of the piston for striking heavy blows. The motor for driving the machine is supported on a bracket bolted to the back of the column, giving a very rigid drive. All operations—holding up, holding down and lifting—are effected by using the air pressure; vacuum is not relied upon for any movements.

Graham and Normanton, of Halifax, are exhibiting on this stand an 8½in. all-geared heavy duty lathe, a photograph of which we reproduce in Fig. 6. The bed of this machine is rigidly constructed to withstand stresses due to heavy cuts at high speeds, and a half-gap is fitted with the object of allowing large diameter castings of small depth to be machined on the face plate without the necessity of removing the gap piece. The fasthead is fitted with a large diameter hollow steel spindle, and the gears are cut from the solid out of heat-treated 45–50 tons tensile steel forgings. They give eight spindle speeds, screws. The controls, it will be observed, are grouped in a position convenient for the operator. A planing machine by the same makers has a very rigid bed and tables, and the latter are easily moved for setting by means of adjusting screws mounted on ball thrust washers. It has positive feed speeds of 22, 36 and 56 lineal feet per second, and all four feed rollers are driven. The cutterblocks are carefully dynamically balanced, and a little carborundum slip is carried on a slide for truing the blades in the machine. When not in usé this device swings out of the way.

La firma Loudon Hermanos, Ltda., de Londres, son agents sudamericanos de un número de fabricantes de máquinas para herramientas y para trabajar madera, y se verá una gran variedad de tales máquinas en su muestrario, en tanto que ellos, por si mismos, exponen una máquina de acepillar metales horizontal, movida por electricidad, capaz de dar un número de velocidades de corte de 11·5 m. per minuto a 375′ p. min. [115 m.], con velocidades de retorno hasta de 375′ p. min. Todos los movimientos van controlados por botones de contacto. También se muestra una sierra para cortar metales hecha por ellos mismos.

Un martinete neumático a motor de 3 quint. [152 kilo.] construido por R. G. Ross & Son, Ltda., de Glasgow, a la vista en su stand, puede dar 150 golpes por minuto. Está arreglado de tal modo que puede ser manejado por la mano o por los pedales de pié. Los fabricantes consideran que el sistema de dos válvulas incorporado en él da al martillo una superioridad considerable en lo que concierne a control y violencia del golpe. Las válvulas son del tipo de gran diámetro y van conectadas con el cilindro por pasajes cortos y anchos, asegurándose así un movimiento sin restricciónes entre el compresor y los cilindros del martinete. La holgura en los cilindros de compresión han sido reducidas al mínimum para asegurar el mas alto rendimiento posible en presión activa de aire sobre el pistón para asegurar el dar golpes enérgicos. El motor para mover la máquina va soportado por una ménsula empernada al dorso de la columna, y da así un mando rígido. Todas las operaciones-mantener en alto, abajo, y levantar-se efectúan por presión de aire; no se usa vacío para nada en estos movimientos. Los Sres, Graham & Normanton, de Halifax, exponen en este stand un torno de trabajo pesado de 8½″ [216 mm.] todo a engranages, cuyo fotografía reproducimos en la Fig. 6. La base de esta máquina está hecha rígidamente para que resista grandes esfuerzos debido a cortes profundos a altas velocidades, y va provisto de una media escotadura con el objeto de permitir fundiciones de mucho diámetro y poca altura ser torneadas en el mandril sin necesidad de retirar toda la escotadura. La polea motora lleva un eje hueco de acero de gran diámetro, y los engranages están hechos cortando de las barras forjadas y recocidas de 40–50 toneladas de tenacidad.

Dan 8 velocidades de eje, y los engranages de inversión van mandados por una manija; no se necesitan llaves. El empuje producido cuando se agujerea o tornea es soportado por arandelas centros de empuje de bolillas. El cabezal suelto, a mas de tener una base larga y convenientemenete afirmada tiene un eje que pasa a través de todo el cilindro, con los que se asegura rigidez y resistencia aún cuando el torna puntas esté salido al máximo de distancia. El branque es del tipo de pared doble, provisto de una tuerca de bronce de cañones para engranar con el tornillo de guía. Las manijas estàn en él trincadas de tal manera que es imposible embragar dos movimientos opuestos al mismo tiempo. El tornillo guía solo se usa para cortar tornillos. Está hecho de acero de gran tenacidad. La alimentación es mandada por un eje separado, el que puede girar a veinte velocidades, según la posición de las manijas que gobiernan la caja de engranages. La máquina como puede verse en la Fig. 6, es movida por un motor eléctrico colocado encima de ella. Va provisto de un botón de contacto para control.

De los objetos expuestos en este stand fabricados por los Sres. Thomas White & Son, Ltd., los dos mas interesantes son la cepilladora para planchas grandes pesadas y la canteadora de borde derecho. La Fig. 7 muestra la canteadora. Se verá que la madera va entragada por una cadena hacia adelante, contra la cual es mantenida por rodillos. En el extremo de entrada hay una saliente ajustable fija a la mesa para guiar la madera cuando entra a la máquina. Por consiguiente la cadena y los rodillos la mantienen y la empujan, de tal modo que la variación o desviación de la línea recta, según los fabricantes, es solo de 1/100 mm. La cadena se mueve en vías de forma de "V" para asegurar alineamiento cuando haya desgaste, pero para reducir esto al mínimum hay un sistema de anaceitado mecánico que provée de aceite regularmente a las arañas de alimentación, en tanto que un repasador mantiene los brazos libres de basura y de aserrín. El alineamiento de las varias partes se hace fácilmente por medio de tuercas ajustables y tornillos. Los controles, se observarà están agrupados en una posición conveniente para el operador. Otra cepilladora de los mismos fabricantes tiene una base y mesa muy rígidas, y las últimas son movidas muy fácilmente para ajustes por medio de tornillos de ajuste montados en cojinetes de empuje de bolillas. Tiene alimentaciones positivas de 22, 36, y 56 piés lineares p. seg. [6·7; 11; 17 m.] y los 4 rodillos de alimentación son mandados. Los cabezales porta-cuchillas van equilibrados muy cuidadosamente, y una pequeña barrita de carborundum va en un cursor para centrar las hojas en la máquina. Cuando no está en uso este artificio se desplaza a un lado fuera del movimiento.

THE SUPERHEATER COMPANY, LTD.

Perhaps the most interesting of the exhibits of the Superheater Company, Ltd., of London, is the multiple valve regulator, illustrations of which are reproduced in Figs. 8 and 9. The apparatus consists of a through-bolt type header with which is cast integrally a chamber for housing the regulator valves and cam shaft. The valves, which are of comparatively small diameter, are operated by a cam shaft and cams, but springs are eliminated and closing is effected by positive mechanical action of the cams. The valves are balanced so that very little effort is required to move them. A pilot valve which opens first admits steam to the balancing chamber before the main valves open; these follow in succession, the first to lift being that in the centre, so that the passage of the steam through the superheater and regulator is uniform thus providing a good graduation of the supply of steam to the cylinders of the locomotive.

The makers claim a number of advantages for the arrangement of the regulator in the smoke-box as in Fig. 9. They point out, for example, that the auxiliaries can always be supplied with superheated steam, and that there is quicker response to movement of the regulator owing to the small clearance space between it and the cylinder. Advantages of the multiple valves are that they remain tight with very little attention; that control is very quick and easy; and that the number of joints in the smoke-box is reduced to a minimum.

In operation a rod is taken from a lever in the cab through the hand railing to the smoke-box. The first movement of this rod opens the pilot valve; further movements lift the main valves in succession. The valves are closed by mechanical action of the cams assisted by their own weight, and the pressure of the steam on top of them. When closing the pilot valve operates last, and the steam in the balancing chamber leaks away into the steam pipes.

The only maintenance required is that of keeping the

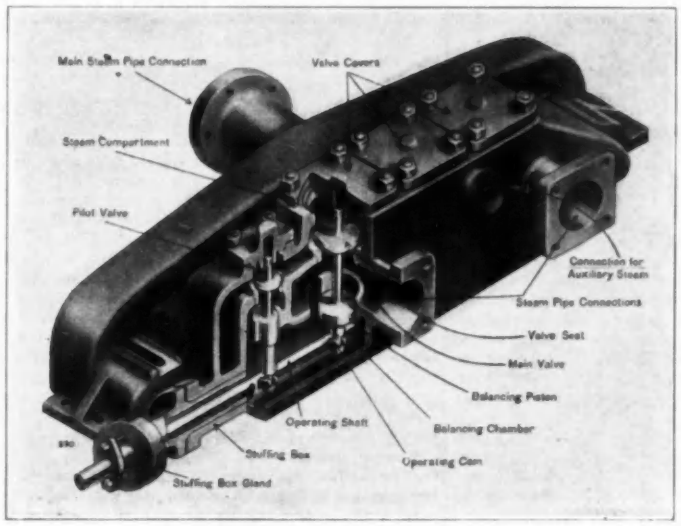


FIG. 8—REGULATOR—SUPERHEATER CO.

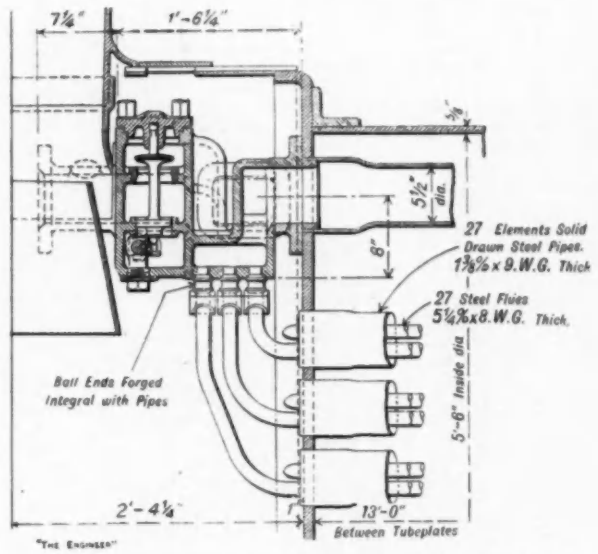


FIG. 9—SECTION THROUGH SMOKE-BOX—SUPERHEATER CO.

stuffing-box on the operating shaft packed and giving periodical attention to the valves. Although introduced comparatively recently, the multiple valve regulator has been fitted to locomotives belonging to twenty-five different railways throughout the British Empire, and four railways in South America have this type of header in service.

The firm is also exhibiting superheater element return bends, some sample element ball ends, and a number of drawings illustrating designs of superheater headers and installations at several power stations.

Quizás la instalación más interesante expuesta por la Superheater Company, Ltda., de Londres, es el regulador de válvulas múltiplas, del que la Figs. 8 and 9 reproduce una fotografía. Este aparato consta de un colector del tipo de pasadores, con la que está fundida en masa una cámara para alojar las válvulas del regulador y el eje de distribución. Las válvulas, que tienen un diámetro relativamente pequeño, están accionadas por un eje de distribución y levas, pero no tienen muelles y su cierre es obtenido por las acción positiva mecánica de las levas. Las válvulas están compensadas de forma que se requiera un esfuerzo muy pequeño para su movimiento. Una válvula-piloto que se abre la primera, hace entrar el vapor en la cámara de compensación antes que se abran las válvulas principales; estas últimas siguen sucesivamente, siendo la del centro la primera en levantarse, de modo que el paso del vapor a través del recalentador y regulador es uniforme, obteniéndose en esta forma una buena graduación de suministro de vapor a los cilindros de la locomotora.

Los constructores sostienen que la disposición del regulador entre el recalentador y los cilindros posee muchas ventajas, Fig. 9. Hacen notar, por ejemplo, que los aparatos auxiliares pueden ser siempre abastecidos con vapor recalentado y que el movimiento del regulador se transmite mas rápidamente debido a la pequeñez del espacio libre entre dicho regulador y el cilindro. Las ventajas de las válvulas múltiplas pueden resumirse así; se mantienen bien sujetadas sin necesidad de atenderlas mucho; la maniobra es muy rápida y facil y el número de uniones en la caja de humo es reducida al mínimum.

Para el functionamiento se emplea una varilla accionada por una palanca desde la garita del maquinista y que corre a lo largo del pasamanos hasta la caja de humo. El primer movimiento de esta varilla abre la válvula-piloto y los movimientos ulteriores hacen levantar sucesivamente las válvulas principales. Las válvulas se cierran por efecto de la acción mecánica de las levas y de su propio peso y además, de la presión de vapor. Cuando se cierran, la válvula-piloto funciona la última y el vapor de la cámara de compensación se escapa a los tubos de vapor.

La única manutención que se necesita consiste en mantener empaquetado el prensa-estopas del eje de mando y atender de vez en cuando a las válvulas. Aunque puesto en el mercado con fecha relativamente reciente, el regulador de válvulas múltiplas ha sido empleado en locomotoras de 25 lineas de ferrocarriles diferentes del Imperio Británico y cuatro lineas de ferrocarriles sudamericanos lo emplean igualmente.

Esta casa exhibe igualmente codillos de vuelta para elementos de recalentadores, algunas cabezas esfericas y varios dibujos que muestran tipos de colectores de recalentadores y de instalaciones en varias centrales eléctricas.

J. A. RAE AND CO.

A number of firms for whom J. A. Rae and Co., Ltd., of Buenos Aires, are the agents are making a

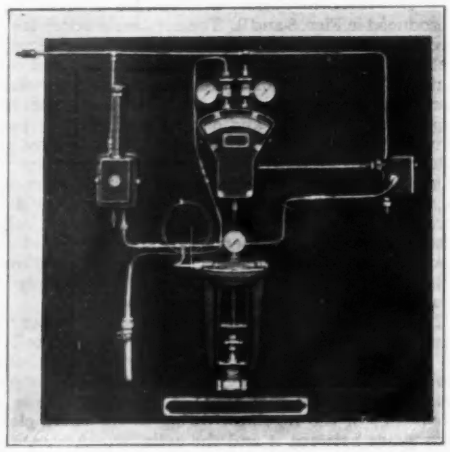


FIG. 10—INSTRUMENT PANEL—DRAYTON

joint exhibit which is actually at work. Hartley and Sugden, Ltd., of Halifax, show a number of low-pressure boilers for central heating, cooking, and so forth, many of which are fitted with apparatus for oil firing by Kermodes, Ltd., of Liverpool; while the Rotoplunge Pump Company, Ltd., of London, is supplying the pumping machinery required. The instruments used in connection with the exhibits, which are made by the Drayton Regulator and Instrument Company, Ltd., West Drayton, have many points of interest. We reproduce a photograph—Fig. 10—of one of the two instrument panels. A dial set temperature regulator is the most prominent feature on the panel, and the drawing—Fig. 11—illustrates the operating principle. The helical tube 1 coils or uncoils according to the changes of temperature in the bulb 2, moving with it the pilot valve plate 3. This has the effect of opening and closing the pilot valve 4, which causes the diaphragm 5 to expand or contract, thus opening or closing the main pilot valve 6. Air at a pressure of about 15 lb. per square inch is supplied to the instrument just below the right-hand gange, and is guided along a pipe to the main diaphragm valve on the left. Its pressure at this point varies according to the degree of leakage allowed at the main pilot valve 6, so that the position of the main direct-acting valve operated by the diaphragm valve is altered according to the temperature of the bulb 2. Movement of the pointer connected to the helical tube controls the point at which the temperature will be held steady.

The principle underlying this new instrument is to obtain maximum rapidity of response to movements of the impulse device caused by the fluctuating temperature of the bulb. If the diaphragm chamber, such as that to be found above the valve, is to be charged and discharged rapidly, a fair-sized pilot valve and leak port must be used. But to obtain rapid transmission of the thermometric impulse to the relay system a small diameter nozzle, which can be opened or closed by a very slight movement, is essential. Hence the necessity for the two leak ports. A very small nozzle can be used to transmit the

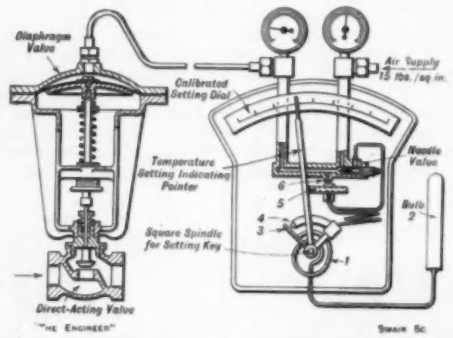


FIG. 11—TEMPERATURE REGULATOR—DRAYTON

slightest movements of the helical tube to the light capsule, which can itself control a larger leak port on the main relay system.

Fig. 12 is a reproduction of a photograph of a thermostatically controlled switch. By making use of a permanent magnet a snap action has been obtained on this switch, so that it can be used successfully within a very small differential. The instrument is of the type in which a coil of bi-metallic strip winds or unwinds in response to fluctuations of temperature. The strip carries a blade, at the further end of which there is a contact which can make or break the circuit at a given temperature. The fixed contact is embraced by a permanent magnet. Thus if the circuit is made the magnet will hold the travelling contact in position until, by reason of the alteration of temperature, the thermostatic metal has gained sufficient power to overcome its attraction, when contact will be rapidly broken. In the other direction a slight movement of the travelling contact will bring it sufficiently under the influence of the magnet to force it to make contact quickly.

Among the other exhibitors under the same agency, Ernest West and Benyon, Ltd., Lambeth, London, are showing an ammonia compressor working on an ice-making tank containing six 14-kilo. ice moulds. The circulating medium is brine, which flows from the tank to an insulated show counter with a plate-glass front. The machine is force lubricated throughout, except for a pedestal bearing, which is ring oiled. The Uniflow arrangement is employed. The compressor is suitable for direct coupling or it can be driven by belt or rope.

Varias firmas, representadas por los Sres. J. A. Rae and Co., Ltd., de Buenos Aires, exhiben juntas una instalación que se encuentra efectivamente en funcionamiento. La Casa Hartley and Sugden, Ltd., de Halifax, tiene expuestas varias calderas de baja presión para calefacción central, cocinas, &c., estando muchas de ellas provistas con aparatos para hogares a combustible líquido de la Casa Kermodes, Ltd., de Liverpool; la Casa Rotoplunge Pump Company, Ltd., de Londres, suministra los grupos de bombas necesarios. Los instrumentos empleados con relación a los aparatos expuestos y que están construidos por la Drayton Regulator and Instrument Company, Ltd., de West Drayton, tienen muchas características interesantes. En la Fig. 10 reproducimos la fotografía de uno de los dos cuadros de instrumentos. El aparato más interesante de dicho cuadro es el regulador de cuadrante o de temperatura fija, cuyo principio de funcionamiento está ilustrado por el dibujo de la Fig. 11. El tubo helicoidal 1 se arrolla o desenrolla, de acuerdo con las variaciones de temperatura en la ampolla 2, moviendo al mismo tiempo la plancha 3 de la válvula piloto. Esto produce la apertura o cierre de la válvula piloto 4 que hace dilatar o contraer el diafragma 5 y por lo tanto abrir o cerrar la válvula piloto principal 6. Aire a la presión de unas 15 lib. p. pul. cuad. [1·0 at.] es suministrado al instrumento justo en la parte inferior del manómetro de la derecha y conducido por una cañería a la válvula de diafragma principal que se encuentra en la izquierda. Su presión en este punto varía con el grado de escape permitido en la válvula piloto principal 6, de modo que la posición de la

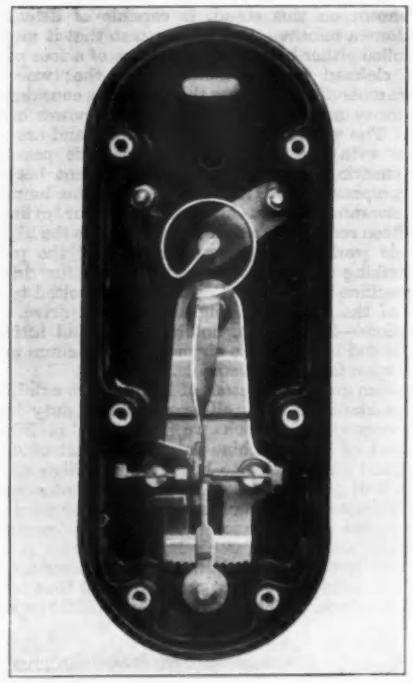


FIG. 12—THERMOSTATIC SWITCH—DRAYTON

válvula principal de acción directa movida por la válvula de diafragma varía de acuerdo con la temperatura de la ampolla 2. El movimiento del índice conectado al tubo helicoidal regula el punto en que la temperatura debe ser mantenida permanentemente.

El principio básico de este nuevo instrumento es de obtener una rapidez máxima de sensibilidad a los movimientos del mecanismo de impulsión originados por las variaciones de temperatura de la ampolla. Si la cámara del diafragma, tal como se encuentra sobre la válvula, debe ser cargada y descargada rápidamente es necesario usar una válvula-piloto y un orificio de escape de tamaño regular. Sin embargo, para conseguir una transmisión rápida del impulso termométrico al sistema de relé es esencial la presencia de una tobera de pequeño diámetro que pueda ser abierta o cerrada por un movimiento muy pequeño. He aquí la necesidad de dos orificios de escape.

Puede usarse una tobera muy pequeña para transmitir los movimientos más menudos del tubo helicoidal a la ligera cápsula que puede controlar por sí un orificio de escape más grande en el sistema de relé principal.

La Fig. 12 reproduce la fotografía de un interruptor controlado termoestáticamente. Mediante el uso de un imán permanente se ha obtenido en este interruptor un movimiento de disparo, de forma que puede ser usado satisfactoriamente con una tolerancia mu pequeña. El instrumento pertenece al tipo en que una bobina de cinta bimetálica se arrolla o desenrolla de acuerdo con las variaciones de temperatura. La cinta lleva una hoja, en el extremo más distante de la cual hay un contacto que puede cerrar o abrir el circuito a una temperatura determinada. El contacto fijo está rodeado por un imán permanente. En esta forma si se cierra el circuito el imán mantiene el contacto móvil en su posición hasta que, por efecto de la variación de temperatura, el metal termoestático ha adquirido una potencia suficiente para vencer su atracción, en cuyo caso el circuito se abre rápidamente. En la dirección opuesta un pequeño movimiento del contacto móvil será suficiente para atraerlo al campo de influencia del imán y forzarlo a cerrar el circuito rápidamente.

Entre los otros exhibidores de la misma Agencia, la Casa Ernest West and Benyon, Ltd., de Lambeth (Londres), tiene expuesto un compresor de amoniaco, con tanque para la fabricación de hielo que contiene 6 moldes, cada uno para 14 kilos. de hielo. El medio de circulación es salmuera que corre del tanque a un mostrador aislado con frente de cristal. La máquina tiene lubrificación forzada en todas sus partes, con excepción de un cojinete de pedestal que tiene lubrificación de anillo. Se emplea el sistema unidireccional, Uniflow. El compresor es adecuado para acoplamiento directo o para transmisión por correa o cable.

COCHRAN BOILERS.

Cochran and Co. (Annan), Ltd., of Annan, Scotland, are showing one of their standard type boilers—see Fig. 13. It is 4ft. diameter by 9ft. high, with 120 square feet of heating surface, and the pressure is 100 lb.

per square inch. It is fitted with an extension to the bottom of the shell to receive a Laidlaw-Drew steam jet oil burner and is equipped with a fire-grate below the burner for coal firing. The oil burner is introduced through the fire door and is of the swivel type, so that it can be rapidly withdrawn when it is desired to change over to solid fuel. The boiler is capable of evaporating 650 lb. per hour with coal firing and 780 lb. per hour with oil firing. The Laidlaw-Drew oil burner is illustrated in the drawing Fig. 14. It will be seen that it consists of two parts: a main body fitted with a control valve, and a nozzle. It is of cross form; one of the pipes forming the cross conveys the oil to the valve, which is controlled by the hand wheel at the end of the body; this hand

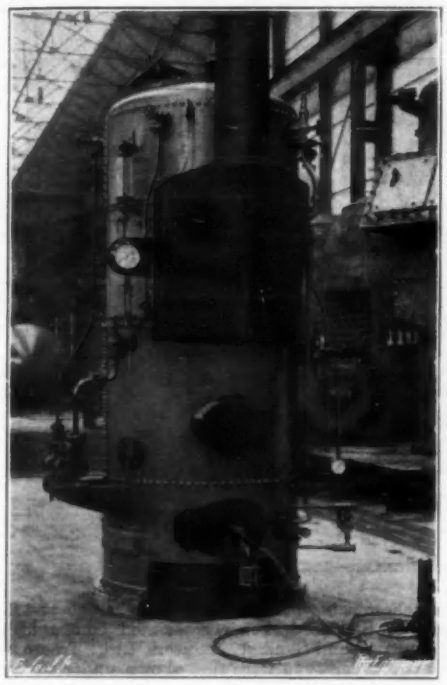


FIG. 13—VERTICAL BOILER—COCHRAN

wheel is insulated from the main rod of the valve. The gland through which the rod passes is of the split sleeve type, which enables the entire oil valve assembly to be removed by detaching the gland nut only. When the valve is opened the oil can flow down the central spindle to the nozzle. The other pipe forming the cross conveys the air or steam used for the atomisation of the oil to an annular space around the spindle. Fig. 14 also illustrates the nozzle in greater detail; it consists of three parts—the choke, the swirler, and the film screw. The air passing down the annular space passes into the swirler, the surface of which is grooved in a helical form; as the swirler is a good fit in the choke, the air is forced to take up a

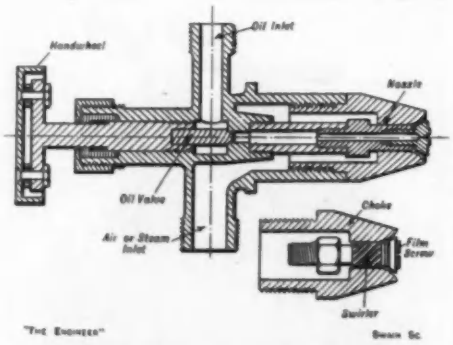


FIG. 14—LAIDLAW-DREW OIL BURNER

swirling motion. The angle of the helix and the cross-sectional area of the passages have an important effect upon the shape of the flame and the amount of air passing through. The oil passing up the hollow stem of the film screw issues out into the air stream at the underside of the head of the film screw at the end of the swirler. The atomisation produced by this method is so fine that the makers claim that the resulting mist will remain in suspension for a considerable period. Messrs. Laidlaw, Drew have also equipped the boiler of a steam rail car exhibited on another stand by the Birmingham Carriage and Wagon Company with a burner of a slightly different type.

Cochran and Co. (Annan), Ltd., de Annan, en Escocia, exponen una de sus calderas normales-véase Fig. 13. Tiene 4′ de diá. por 9′ de altura, [1·2 m. ×2·7 m.] con 120 piés cuad. [11 m²] de superficie de calefacción, y la presión es de 100 lib. p. pul. cuad. [6·8 at.]. Tiene una extensión en el fondo del casco para adaptarle un quemador de petróleo de Laidlaw-Drew a vapor y una parrilla bajo el quemador para quemar carbón. El quemador de petróleo se introduce por la boca del hogar y es del tipo articulado para que pueda ser puesto a un lado cuando se desea cambiar y quemar carbón. La caldera puede evaporar 650 lib. de vapor p hora [295 kilo] quemando carbón y 780 [354 kilo] quemando petróleo. La Fig. 14 muestra el quemador de petróleo de Laidlaw-Drew. Se verá que consiste de dos partes: un cuerpo principal provisto de una válvula de control, y un pulverizador. Tiene forma de cruz; uno de los caños que forman la cruz lleva el petróleo a la válvula, la que se gobierna por medio de la rueda de mano que va al extremo del cuerpo; esta rueda está aislada del vástago principal de la válvula. El prensaestopa por el cual pasa este vástago es del tipo de manchón o manguito hendido, lo que permite al conjunto de la válvula de aceite el ser sacada aflojando solo la tuerca del prensaestopa. Cuando la válvula se abre el aceite fluye hacia abajo del vástago central hacia el pulverizador. El otro tubo que forma la otra rama de la cruz lleva el aire o vapor usado para la pulverización del combustible a un espacio anular alrededor del vástago. La Fig. 14 muestra el pulverizador en una escala mayor; consiste de tres partes—el cierre, el agitador, y el tornillo de afine. El aire que pasa por el espacio anular pasa al agitador cuya superficie está estriada en forma de hélice; como el agitador rodea estrechamente al cierre, el aire es forzado a girar en remolinos. El ángulo de la espiral y el área de los pasajes tiene un efecto importante sobre la forma de la llama y la cantidad de aire que puede pasar. El aceite que pasa por el eje hueco del tornillo de afine entra la corriente de aire por el lado bajo de la cabeza del tornillo de afinar al extremo del agitador. La pulverización producida por este método es tan fina que los fabricantes sostienen que la niebla que resulta se mantendrá en suspensión por un considerable período. Los Sres. Laidlaw-Drew tienen también equipada la caldera de un coche motor de ferrocarril la que está expuesta en el estante de La Cía. Birmingham Carriage and Wagon, con un quemador de un tipo algo diferente.

HADFIELDS LTD.

Hadfields Ltd., of Sheffield, are exhibiting a number of their crushing machines, together with accessories for them; tramway and railway track work and dredging machinery components; and various stainless and corrosion-resisting steels.

The most interesting machine on the stand is a crushing and screening plant of new design, which is specially constructed to meet the conditions existing in the Argentine and other markets in South America. We reproduce a photograph of the machine, Fig. 15, from which it will be seen that it consists of two units built on separate carriages, with the object of facilitating transport over the rough and hilly roads likely to be met with in partly undeveloped country. One of the carriages carries the stonebreaker and the other has a steel structure built up upon it to support the screen, elevator and discharging hoppers. The breaker has been designed with a feed mouth of liberal dimensions, easy of access, and the rejection chute is carefully arranged not to block the mouth. The tail end of the elevator is above the ground level, so that there is no necessity to dig a pit to accommodate it. The feeding platform is so arranged that the attendant can stand in an upright position and feed the breaker in comfort, and the chutes for the discharged products are sufficiently far above the ground for lorries or trucks to be run directly beneath them. After being crushed, the material is carried to the top of the machine by a bucket elevator, from which it is discharged into the revolving screen. This grades the crushed stones into three sizes and a chute at the end passes any stones insufficiently crushed back into the mouth of the breaker for further reduction.

The breaker itself is a Hadfield solid steel stone-crusher of the double toggle type. The dimensions of the mouth are 16in. by 9½in., and the makers claim that it is the lightest and strongest breaker on the market. "Era" manganese steel, a Hadfield patented material, is used in the construction of the jaws and all other renewable parts. The machine is in actual operation and is erected in the open air in the Crushing Machinery Section.

Besides the breaker described another portable set with a screen incorporated and a disc crusher are exhibited by the firm, which is also showing a wide range of products in "Era" steel and a number of other interesting items in conection with tramway and railway work.

Hadfields Ltd., de Sheffield, exhiben una serie de sus machacadoras, junto con accesorios para las mismas; rieles, cambios y cruziamentos para vías de tranvía y ferrocarril; partes de máquinas de dragar; y varios aceros inoxidables y contra ácidos, etc.

La máquina más interesante que se exhibe en este Stand, es una instalación de machacado y cribado, de modelo nuevo, la que ha sido construida expresamente para llenar las condiciones del mercado Argentino y otros mercados sud-americanos. En la Fig. 15 reproducimos una fotografía de la máquina, por la que se verá que ésta se compone de dos grupos montados sobre carros distintos para facilitar su transporte por los caminos accidentados y cuestas fáciles de encontrar en países poco desarrollados. En uno de los carros está la quebrantadora de piedras, y en el otro hay un bastidor de acero destinado a sostener la criba, el elevador y las tolvas de descarga. La machacadora tiene una boca de entrada de amplias dimensiones y fácilmente accesible; el canalón de desechos está dispuesto en forma que evite la obstruccion de la boca. El pié del elevador está sobre el nivel del suelo, evitando así la necesidad de abrir un pozo para recibirlo. La plataforma de alimentación está dispuesta de modo que el mecánico pueda permanecer de pie y alimentar la quebrantadora cómodamente, a la par que los canalones para los productos descargados se hallan a bastante distancia del suelo para permitir la llegada de camiones y vagones directamente debajo de ellos. Después de haber sido triturado, el material pasa a la parte alta de la máquina, conducido por un elevador de cangilones, del que se descarga en la criba giratoria, la que clasifica las piedras trituradas en tres tamaños. En el extremo existe un canalón que devuelve a la boca toda de la quebrantadora para su nueva reducción, piedra que no haya sido suficientemente quebran-tada.

La quebrantadora es del modelo Hadfield enteramente de acero sólido y del tipo de doble tejuelo. Las dimensiones de la boca son 16 pul. × 9½ pul. [406 mm. × 241 mm.] y los constructores aseguran que es la quebrantadora más ligera y más resistente en el mercado. En la construccíon de las mandíbulas y demás piezas cambiables, sin excepción se emplea el acero al manganeso "Era"

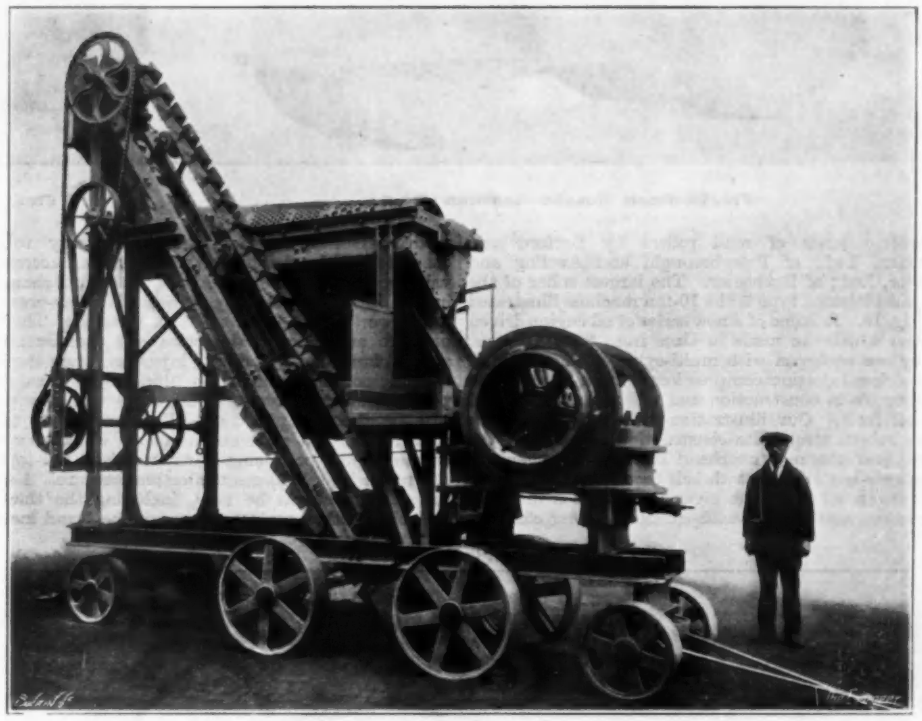


FIG. 15—CRUSHING AND SCREENING PLANT—HADFIELD

patente "Hadfield." Esta máquina podrá verse en movimiento al aire libre, en la Sección de Maquinaria Quebrantadora.

Además de la quebrantadora descrita hay otro equipo portátil, con criba, y una machacadora a disco, que sus constructores exhiben junto con un extenso surtido de productos hechos con acero "Era," y otros varios materiales interesantes relacionados con tranvías y ferrocarriles.

AGRICULTURAL AND GENERAL ENGINEERS, LTD.

On the stand of Agricultural and General Engineers, Ltd., of Aldwych House, London, W.C. 2, there is shown a wide range of road-making machinery, power plant, and agricultural tractors and implements. The road-making plant comprises a representative series of road rollers by Barford and Perkins, Ltd., of Peterborough, and Aveling and Porter, Ltd., of Rochester. The largest roller of the Barford Perkins type is the 10-ton machine illustrated in Fig. 16. It is one of a new series of oil engine driven rollers which are made in sizes from 9 to 16 tons. They are equipped with multi-cylinder oil engines of the airless-injection compression-ignition type, which are simple in construction and will use a wide range of oil fuels. Our illustration clearly indicates the very robust steel plate construction adopted by the firm, and the new overhead steering arrangement. The gear-box is fitted with ball bearings and the gears run in an oil bath. It gives three speeds in either direction, and is fitted with quick reversing clutches.

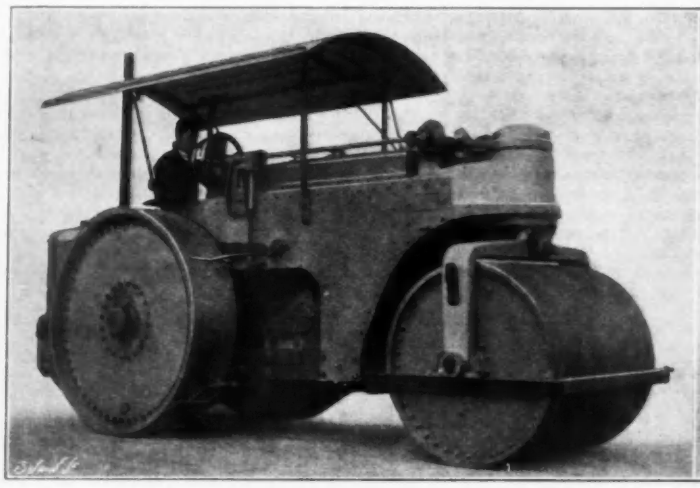


FIG. 16—ROAD ROLLER—BARFORD (A.G.E.)

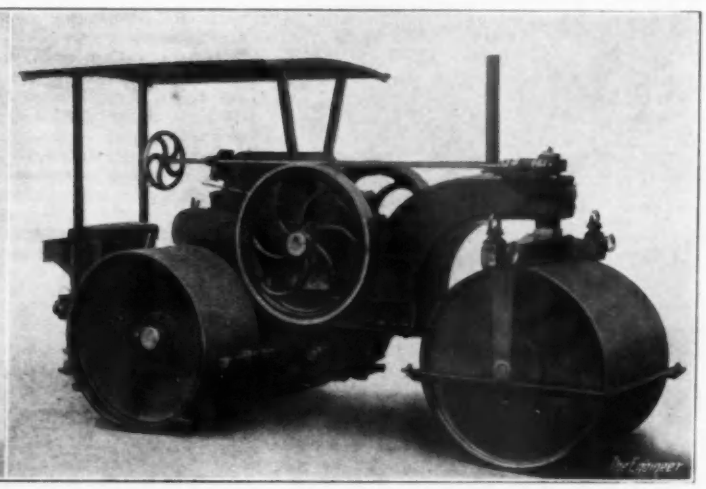


FIG. 17—ROAD ROLLER—AVELING (A.G.E.)

As shown, the rollers are built with steel side plates and provision is made for water-ballasted wheels, with an increase in weight of about 2 tons.

The oil engine driven roller of the Aveling and Porter type shown in Fig. 17 weighs 6 tons and is representative of a range of machines with weights from 3 up to 17 tons. The model we illustrate is propelled by a single-cylinder Blackstone spring-injection engine, with two fly-wheels. The gear-box has ball and roller bearings, and forward and reverse clutches which are spring-controlled, giving a smooth reverse without shock or dwell, are provided. The weight distribution and the good overlap of the wheels make this roller useful for a wide range of work. The complete series of rollers built by the two firms referred to provide machines which are suited to all duties from the lightest form of rolling, such as for aerodromes, footpaths, and bituminous carpeting, up to the heaviest kinds of foundation work. Other oil engine driven machines include a Barford and Perkins 8-ton tandem roller with quick-reverse clutches and power steering, with a water spray and water ballasted wheels. A smaller 2½-ton roller, with a 15ft. turning circle, is also shown, both machines being specially built for asphalt work. Another motor road roller is a 4-ton general-purpose machine, with a 3½ miles per hour travelling speed, while the largest exhibit comprises a new 10-ton steam roller by Aveling and Porter, Ltd.

The power plant comprises two large horizontal oil engines by Blackstone and Co., Ltd., of Stamford, embodying the firm's patented system of spring injection, which is applied to engines ranging from 5 up to 1250 B.H.P. Fig. 18 represents a single-cylinder model. Our illustration shows the very robust character of the design and the neat and accessible valve gear. The fuel is delivered to the fuel chamber in the injection valve by means of a low-pressure pump working at 10 lb. to 15 lb. pressure. The full pressure necessary for injection and atomisation is applied immediately prior to injection, when the fuel is enclosed in the injection block, by means of a powerful spring, thereby doing away with any pressure on the fuel pipe line. The combustion takes place at constant pressure, no matter what the speed of the engine, producing a characteristic flat-topped diagram with a high mean effective pressure. A wide range of fuels can be used, including the thickest fuel oils. Other engines shown on the stand include a 9 B.H.P. cold starting engine, coupled to a Bull D.C. generator, also a series of small engines mounted on skids or wheeled carriages, suited for transport, and some petrol paraffin motors of Blackstone design, from 1½ up to 7 B.H.P.

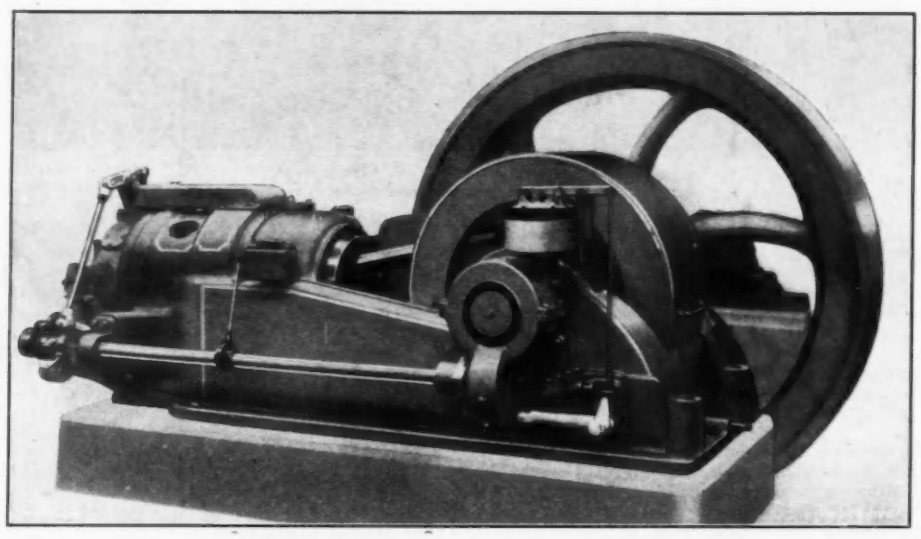


FIG. 18—HORIZONTAL OIL ENGINE—BLACKSTONE (A.G.E.)

Another interesting engine is that exhibited by Davey, Paxman and Co., Ltd., of Colchester, which is of the twin-cylinder vertical type, and is illustrated in Fig. 19. It has a designed output of 70 to 77 B.H.P. This engine is representative of a range of engines of 35 up to 1500 B.H.P., all of which incorporate the patented Blackstone spring-injection principle we have already referred to. The Davey-Paxman engine is extensively used for electric light and power plants and for main propulsion and auxiliary use at sea.

Among the agricultural machinery and implements shown on this stand we may single out for special mention the two A.G.E. tractors, both of which are fitted with four-cylinder, cold-starting oil engines of the high-speed type. One of the tractors is shown in Fig. 20 and represents a Blackstone tractor in which the engine shown in Fig. 21 is installed. The engine has a designed output of 35 to 40 B.H.P. at 1000 r.p.m., and its cylinders are 4⅛in. bore with a stroke of 6in., a compression ratio of 14 : 1 being adopted, with compression ignition. The cylinder casing is of the monobloc type with removable liners, and separate fuel injectors of the Blackstone spring-controlled type. The fuel consumption when using No. 1 Diesel fuel oil at three-quarter to full load is 0·46 lb. per B.H.P. hour. The engine is arranged for starting by means of a small petrol engine. The other tractor exhibited was designed by Aveling and Porter, Ltd., of Rochester, both that firm and Blackstone and Co., Ltd., of Stamford, being associated companies of Agricultural and General Engineers, Ltd. Tractors of this particular type were first shown under working conditions at the World Tractor Trials held at Ardington, in England, in September, 1930. The fuel consumption was very low and the high-speed engine gave a very even torque and draught, which is an essential feature of successful ploughing. One of the tractors fitted with an "Invicta" engine made by Aveling and Porter, Ltd., ran nearly 1000 hours in a six weeks' non-stop ploughing test, thereby achieving the record for a farm tractor endurance test.

The Bedford firm of James and Frederick Howard, Ltd., another of the associated A.G.E. companies, is showing a large selection of ploughs, harrows and cultivators for animal and tractor draught, including the latest three, four, and five-furrow tractor ploughs with special self-lifting attachments. Another firm in the A.G.E. group, namely, E. H. Bentall and Co., Ltd., of Heybridge, Maldon, Essex, is exhibiting a wide range of chaff cutters, grinding mills, and other barn machinery and food preparing plant. An interesting agricultural exhibit is the "Sunshine" harvester thresher, which is manufactured by the H. V. McKay (Proprietary), Ltd., of Melbourne, Australia, whose machinery is dealt with in the Argentine by Agricultural and General Engineers, Ltd. Two forms of the machine are shown, including the "Autoheader," which is an entirely self-contained unit providing its own motive power as well as power for driving the corn cutting and threshing mechanism. With this machine only two attendants, a driver and a man to operate the bagging chutes, are needed.

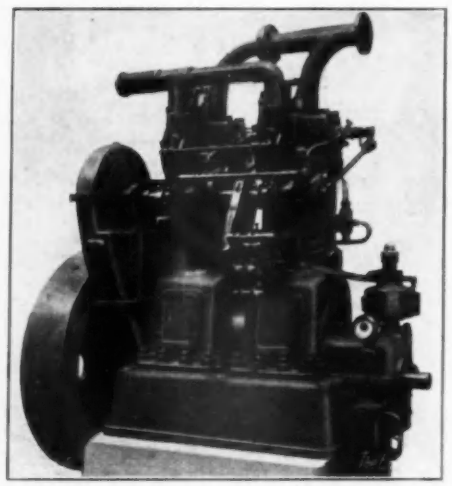


FIG. 19—OIL ENGINE—PAXMAN (A.G.E.)

En el pabellón de los Ingenieros Agrícolas y Generales, Ltda., de Aldwych House, W.C. 2 de Londres, hay a la vista un surtido enorme de maquinaria para hacer caminos, usinas de energía, y tractores agrícolas e implementos. La maquinaria para caminos comprende una série representativa de apisonadores mecánicos de Barford & Perkins, Ltd., de Peterborough, y de Aveling & Porter, Ltd., de Rochester. El mayor apisonador del tipo Barford Perkins es la máquina de 10 toneladas que se ve en la Fig. 16. Es uno de los nuevos pisones movidos por petróleo crudo fabricados en tamaños desde 9 a 16 toneladas. Van equipados con motores de petróleo a cilindros múltiples de inyección sin aire y tipo de compresión-ignición, los que son de construcción sencilla y utilizan una vasta variedad de aceites crudos. Nuestra figura muestra claramente la robusta construcción de chapa de acero adoptada por la firma, y el nuevo arreglo para manejar alto. La caja de engranages tiene cojinetes de bolas y los engranages trabajan en un baño de aceite. Tiene tres velocidades en cualquier dirección, y va provista de ambragues de contramarcha rápida. Como se ve, los pisones están hechos de placa de acero laterales y se deja espacio para ruedas lastradas con agua, lo que aumenta el peso en cerca de 2 toneladas. El pisón de petróleo de Aveling & Porter se ve en la Fig. 17, pesa 6 toneladas y representa el tipo de un diagrama con curva aplanada al tope, característica, con una presión media efectiva muy alta. Una gran variedad de aceites crudos puede usarse incluyendo los mas espesos. Otros motores en el mismo stand incluyen el de arranque en frío de 9 H.P., acoplado a un generador Bull de corriente contínua, y una série de motores pequeños montados en bastidores con patines o ruedas, fáciles de transportar, y algunos motores de kerosene del tipo Blackstone desde 1½ H.P. hasta 7 H.P.

Otro motor interesante es el expuesto por Davey, Paxman & Co., Ltd., de Colchester, del tipo de cilindros gemelos verticales, como se ve en la Fig. 19. Da un rendimiento calculado de 70 a 77 H.P. Este motor es típico de la variedad de motores desde 35 H.P. hasta 1500 H.P., todos los cuales presentan el sistema patentado de Blackstone de Inyección de salto a resorte ya mencionada. La máquina Davey-Paxman es muy usada para plantas eléctricas para luz y fuerza, para propulsión y para usos auxiliares en el mar.

Entre los implementos y maquinaria agrícolas que se exponen en este pabellón debemos hacer notar especialmente los dos tractores A.G.E., embos movidos por motores de 4 cilindros de aceite crudo, arranque en frío y alta velocidad. Uno de los tractores se ve en la Fig. 20 y representa un tractor Blackstone que tiene un motor como el representado en la Fig. 21.

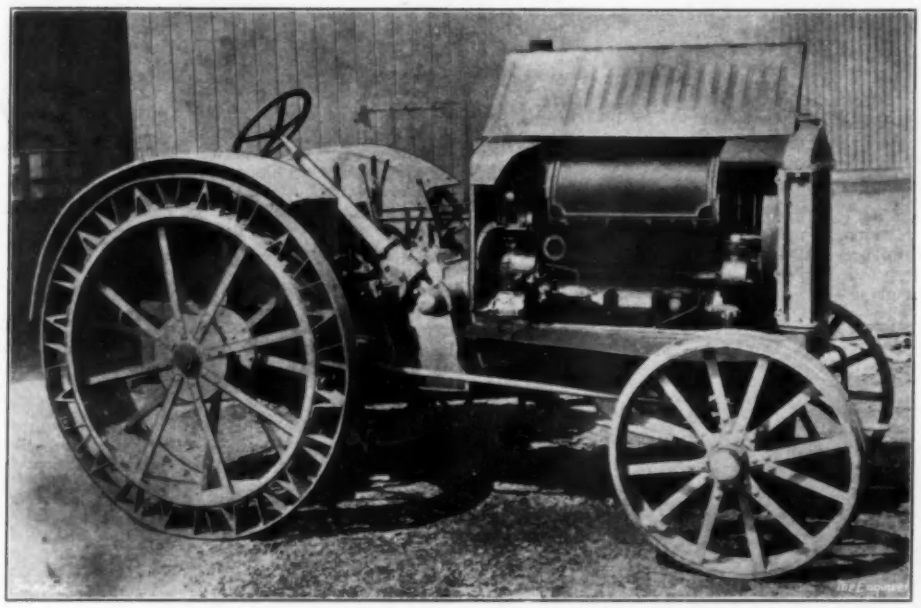


FIG. 20—OIL ENGINE DRIVEN TRACTOR—BLACKSTONE (A.G.E.)

máquinas cuyo peso varía desde 3 hasta 17 toneladas. El modelo que mostramos va impulsado por un motor Blackstone de un cilindro, de inyección de salto con dos volantes. La caja de engranages tiene cojinetes de bolas y rodillos, y embragues para adelante y atrás con controles a resorte, lo que proporciona una contramarcha suave sin choques ni retardos. La distribución del peso y la amplia sección saliente de las ruedas hacen este pisón útil para una gran variedad de trabajos. La série completa de pisones mecánicos automotores hecha por las dos firmas mencionada proporciona máquinas que sirven para todos los trabajos, desde aplanadoras livianas, como para aeródromos, caminos de parques, y recubrir con mezclas bituminosas, hasta los trabajos mas pesados de fundación. Otras máquinas movidas por aceites crudos incluyen una aplanadora tandem de 8 toneladas de Barford & Perkins con embragues de contramarcha rápida y gobierno mecánico, con una regadera para agua y ruedas lastradas con agua. Una aplanadora mas pequeña de 2¼ toneladas que gira en un círculo de 15' [4·6 m.], también se expone, siendo ambas máquinas especialmente hechas para trabajar asfalto. Otra aplanadora automotora es una de 4 toneladas para todo uso, con una velocidad de camino de 3½ mil. p. hora [5·5 km.] pero el artículo mas grande de los expuestos es un pisón de vapor de 10 toneladas de Aveling & Porter, Ltda.

Las instalaciones productoras de energía comprenden dos motores horizontales grandes de aceite crudo de Blackstone & Co., Ltda., de Stamford, en el que va incorporado el sistema de inyección patentado de salto por resorte, el que se aplica a motores que varían de 5 hasta 1250 H.P. La Fig. 18 representa un modelo de un cilindro. Nuestra figura muestra el muy robusto carácter del diseño y la disposición limpia y accesible del mecanismo de las válvulas. El combustible llega a la cámara de combustible en la válvula de inyección por medio de una bomba de presión baja que trabaja a 10 o 15 lib. [·7—1 at.] de presión. La presión completa necesaria para inyectar y pulverizar se aplica inmediatamente antes de inyectar, cuando el aceite está en el bloque de inyección, por medio de un resorte poderoso, con lo que se evita cualquier presión en el caño de combustible. La combustión tiene lugar a presión constante cualquiera que sea la velocidad del motor, lo que produce El motor está proyectado para dar 35 a 40 caballos a 1000 revoluciones por minuto, y sus cilindros tienen un alma de 4⅝" por 6" [117×152 mm.] de carrera, una compresión de 14 : 1, con ignición por compresor. La envoltura del cilindro es del tipo de bloque enterizo con forros desmontables, y con inyectores aparte del tipo Blackstone de inyección de salto por resorte. El consumo de combustible es 0,46 lib. [·21 kg.] por caballo hora trabajando a ¾ o toda carga y usando petróleo No. 1 para Diesels. El motor tiene para arrancar un motorcito de nafta. El otro tractor a la vista ha sido diseñado por Aveling & Porter, Ltd., de Rochester. Esta firma así como la de Blackstone, de Stamford, son asociados de la Compañía de Ingenieros Agrícolas y Generales, Ltda. Los tractores de este tipo especial fueron expuestos por primera vez en condiciones de trabajo en las pruebas para tractores que tuvieron lugar en Ardington, Inglaterra, en septiembre de 1930.

El consumo de aceite crudo fué muy bajo y el motor de gran velocidad produjo una par de fuerza de arranque y esfuerzo parejos, lo que es un detalle esencial para arar con éxito. Uno de los tractores provisto de un motor "Invicta" de Aveling & Porter, Ltd., anduvo cerca de 1000 horas en una semana de arar sin parar, de prueba, alcanzando así la marca mas alta para una prueba de tractor de granja, en resistencia.

La firma de Bedford, James & Frederick Howard, Ltd., otra de las asociadas de la A.G.E., muestra una variedad de arados, rastras, y cultivadores para tiro por animales o mecánico, incluyendo los arados de levante automático del último modelo de 3, 4, y 5 rejas. Otra firma del grupo de A.G.E., la E. H. Bentall & Co., de Heybridge, Maldon, Essex, exponen un gran surtido de cortadores de pasto, trituradoras, y otros artículos para granja y para la preparación de alimentos. Un renglón interesante es la cosechadora-trilladora "Sunshine" fabricada por H. V. MacKay (Proprietary), Ltd., de Melbourne, Australia, de cuya maquinaria se ocupan en Argentina los Ingenieros Agrícolas y Generales, Ltda. Se verá dos formas de la misma máquina, incluyendo el "Autoheader" que es una unidad compacta que proporciona su propia fuerza así como la necesaria para mover la cortadora de trigo y el mecanismo de trillar. Con esta máquina solo se necesita dos operarios, un conductor y un hombre para manejar las caídas de embolsar.

THOMAS BROADBENT AND SONS, LTD.

The most striking of the exhibits of Thomas Broadbent and Sons, Ltd., of Huddersfield, is a set demonstrating the advantages of a "Broadbent" centrifugal clutch. An electric motor has been set up to drive a brake wheel through the centrifugal clutch and laminated gears. Any desired load can be placed upon the mechanism by means of adjustable weights, and a spring balance indicates the torque. By means of this set it can be shown that the clutch slips during acceleration, picks up the load gradually when the motor is up to speed, and slips again when an overload is put on it. The clutch is composed of a loose exterior rim, with a fast spider within it keyed on to the motor spindle. The spider carries round with it a number of loose shoes in suitably shaped pockets, and the shoes are lined with Ferodo on the outer face. As the speed of the motor increases they are forced outwards to engage with the interior rim of the loose pulley, thus accelerating it slowly to full speed. The weights of the shoes are so adjusted that the clutch is capable of transmitting the full power of the motor, but if an overload is thrown upon it the shoes slip until the load is reduced to normal.

The firm is also exhibiting two hydro-extractors.

Lo mas interesante de lo expuesto por los Sres. Tomás Broadbent e Hijos, Ltda., de Huddersfield, es un juego para demostrar las ventajas del embrague centrífugo de Broadbent. Un motor eléctrico mueve una rueda de freno por intermedio del embrague centrífugo y engranages laminados. Se puede poner cualquier carga para probar este mecanismo por medio de pesos ajustables, y una balanza de resorte indica el valor del par de fuerza. Por medio de este juego se puede demostrar que el embrague resbala durante la aceleración, toma la carga gradualmente cuando el motor acelera, y resbala de nuevo cuando la carga es excesiva. El embrague está compuesto de una banda exterior suelta, con una araña o cubo de rayos fijo adentro calada al eje del motor. La araña tiene en su periferia un número de patines sueltos en escotaduras especiales, y los patines están revestidos de Ferodo en la parte de afuera. Cuando la velocidad del motor aumenta los patines salen por efecto de la fuerza centrífuga y se apoyan en la banda suelta, pasando así su aceleración a esta paulatinamente. Los pesos de los patines están ajustados de tal modo que el embrague es capaz de transmitir

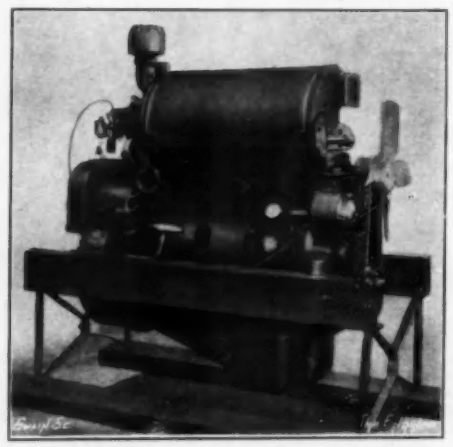


FIG. 21—OIL ENGINE—BLACKSTONE (A.G.E.)

el poder total del motor, pero si sobreviene una carga extraordinaria los patines resbalan hasta que la carga vuelve a ser normal. La firma expone también dos hidro-extractores.

DRYSDALE AND CO., LTD.

Drysdale and Co., Ltd., of Glasgow, are showing a number of centrifugal pumps illustrative of the range that they produce. One of these, with a delivery pipe diameter of 1¼in., is coupled up to supply the water for an illuminated fountain. It is capable of delivering 40 gallons per minute against a total head of 50ft., and is direct coupled to a British Thomson-Houston Company's motor, which is of the A.C. squirrel-cage type.

A 14in. pump with the casing divided horizontally is not coupled up nor is it mounted on a bed-plate. A pump of this type will discharge 3000 gallons per minute against a total head of 27ft. when running at a speed of about 960 r.p.m. A motor-driven pump of the Drysdale "K" type has 6in. suction and discharge branches, and running at 1450 r.p.m. it can give 800 gallons per minute delivery against 60ft. head.

The "Crescent" type of irrigation pump, which the firm is showing, is designed to be driven by belt, and has fast and loose pulleys. Its shaft is supported on ring-oiled pedestal bearings on each side of the pulleys, and it is further supported by a hard bronze bush fitted with a grease lubricator within the pump casing. The impeller, which is machined

where necessary, is made from close-grained cast iron, and is designed to eradicate end thrust due to unbalanced water pressure. This type of pump is made in a wide range of capacities and powers. The one exhibited has a 3in. delivery branch and a 4in. suction. It can be run at speeds from 1100 to 2200 r.p.m., delivering 255 and 650 gallons per minute against heads of 15ft. to 50ft. respectively.

La casa Drysdale and Co., Ltd., de Glasgow, exhibe varias bombas centrífugas las cuales darán una idea de los tipos que construye. Una de estas bombas, cuyo caño impele ntemide 1½ pulg. de diá [38 mm.] está acoplada de forma que pueda suministrar agua a una fuente iluminada. Esta bomba tiene una capacidad de entrega de 40 gal. p. min. [·2 m.³] a una elevación total de 50 piés [15·3 m.] y está acoplada directamente a un motor eléctrico del tipo con inducido en circuito corto, de la British Thomson-Houston Company, para corriente alterna.

Una bomba de 14 pulg. [·35 m.] cuya envoltura está dividida horizontalmente, no está acoplada ni tampoco va montada sobre una plancha de fundación. La capacidad de una bomba de este tipo es de 3000 gal. p. min. [13·6 m.³] a la elevación total de 27 pies [8·3 m.] y a una velocidad de unas 960 r.p.m. Una bomba accionada por motor del tipo "K" Drysdale tiene ramales aspirante y impelente de 6 pulg. [152 mm.], pudiendo entregar 800 gal. p. min. [3·6 m.³] a una velocidad de marcha de 1450 r.p.m. y a una elevación de 60 pies [18·3 m.].

La bomba de riego tipo "Crescent" que exhibe la casa, está estudiada para transmisión por correa, estando provista de poleas fija y loca. Su eje gira en cojinetes de pedestal con lubrificación por anillos, estando dichos cojinetes colocados en cada lado de las poleas; y está además sostenido por un buje de bronce duro provisto de engrasador, estando el buje alojado en el interior de la caja de la bomba. La hélice, labrada a máquina donde sea preciso, está hecha de hierro fundido de estructura fina; su construcción elimina el empuje axial debido a la presión de agua que no está equilibrada. Este tipo de bomba se construye en una serie muy extensa de capacidades y fuerzas. La que se exhibe tiene un ramal impelante de 3 pulg. [76 mm.] y un ramal aspirante de 4 pulg [101 mm.]. Podrá marchar a velocidades que varian entre 1100 y 2200 r.p.m., siendo su capacidad de 255 y 650 gal. p. min. [1·14–2·95 m.³] a las alturas de 15 pies á 50 pies [4·6–15·2 m.] respectivamente.

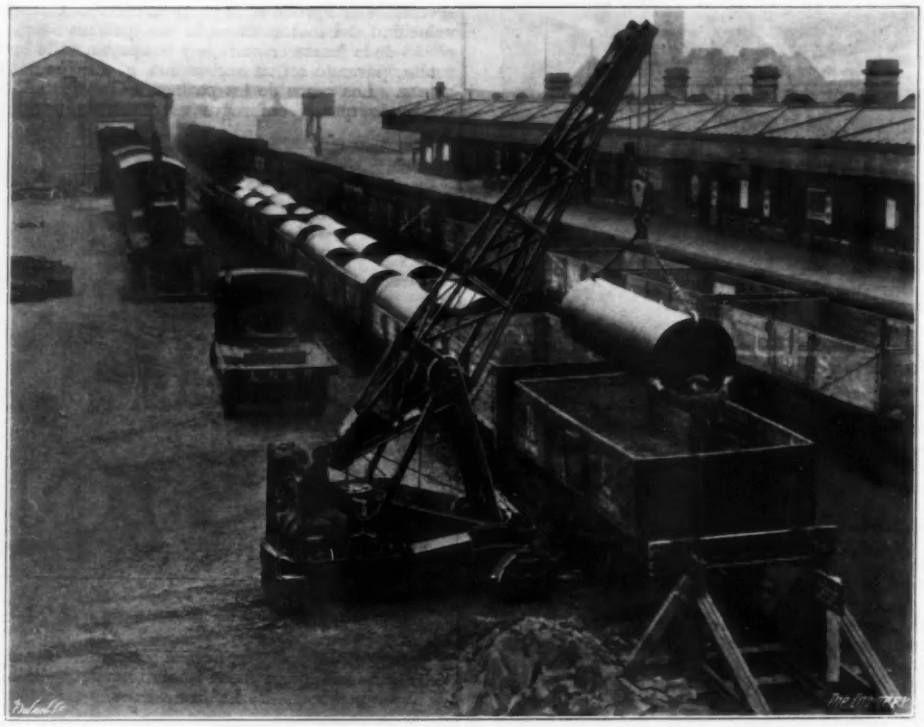


FIG. 22—VERSATILE CRANE—MORRIS

HERBERT MORRIS, LTD.

THE principal exhibits of Herbert Morris, Ltd., are a versatile crane and a ball-bearing pulley block. A photograph of a crane of this type at work is reproduced in Fig. 22. It is designed to carry a maximum load of 5 tons at a radius from the centre of the turning circle of 9ft. 7¾in., and a load of 1¾ tons at 18ft. 4½in. radius. At the inner radius it can lift from 8ft. below ground level to 20ft. above it, and at the outer radius from 22ft. below to 8ft. above ground level. It has a maximum ground speed of 3½ miles an hour, with a hoist at the rate of 25ft. per minute with a full load, and it takes 15 seconds to derrick from maximum to minimum with a 1¾-ton load. Power is provided by a 30 B.H.P., four-cylinder, water-cooled petrol engine, which is directly coupled to a dynamo generating current at a pressure of 100 volts, when running at 2000 r.p.m. One motor operates the hoisting and derricking. It is a totally enclosed compound wound machine, while a second motor, series wound, is used for travelling. Steering is effected by means of an ordinary hand wheel acting through machine-cut spur gearing on the rear wheels. All the wheels are mounted on ball bearings, and are fitted with rubber tires. The hoist and derrick driving units consist of large diameter grooved drums driven by a motor through clutches and spur gearing. The controls throughout are arranged within easy reach of the driver, whose seat is so placed that he has a clear view in every direction.

The excellent mobility of the crane may be judged from Fig. 23, which shows the various positions in which the wheels may be placed. It will be seen that it is capable of getting into corners and round obstacles with great ease.

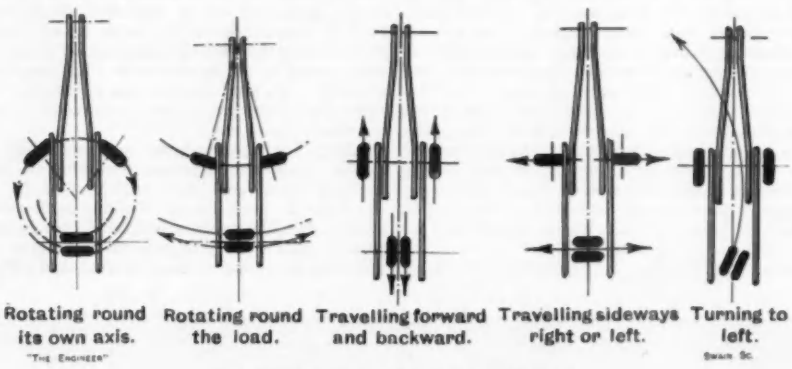


FIG. 23—MOBILITY OF CRANE—MORRIS

Fig. 24 shows a section through the improved Morris ball-bearing pulley block. It will be seen that all parts carrying heavy loads are supported on this form of bearing, ensuring high efficiency. The drive is transmitted from the hand chain wheel on the right along the central shaft to a pinion at the other end, driving two intermediate gears, which, in turn, drive the main load chain wheel. The central shaft is supported on ball bearings, and the load chain is also carried in the main frame in this manner. The intermediate wheels being balanced for thrust, and having therefore very little load upon them, have ordinary bearings. The bearings are lubricated by opening a tight-fitting door covering the gear wheels. Access is then obtained to three nipples. The outer ones convey the grease from the grease gun to the bearings of the intermediate wheels, while that in the centre feeds all the bearings carrying the load. The covers to the gears are arranged to keep grits and dirt out of the bearings, and away from the wheels. The brake works automatically and offers no resistance to lifting, and the chain guard is designed to give a smooth, even pull from any position.

Las máquinas más importantes entre las expuestas por la Casa Herbert Morris, Ltd., son una grúa giratoria y un polipasto con cojinete de bolas. La Fig. 22 reproduce una fotografía de este tipo de grúa en funcionamiento. Ha sido construida para levantar un peso máximo de 5 toneladas con un alcance de 9 pies 7½ pulg. [2·9 m.], o un peso de 1¾ toneladas con un alcance de 18 pies 4½ pulg. [5·6 m.]. Con el alcance inferior puede trabajar desde 8 pies [2·4 m.] debajo del nivel del suelo hasta 20 pies [6·1 m.] sobre dicho nivel y con el alcance superior, desde 22 pies [6·7 m.] debajo del nivel hasta 8 pies [2·4 m.] sobre el nivel. Tiene una velocidad máxima de traslación de 3½ millas [5·5 km.] por hora, con una velocidad de elevación de 25 pies [7·6 m.] por minuto en plena carga y emplea quince segundos en efectuar el desplazamiento vertical de una carga de 1¾ toneladas de maximum a minimum. La fuerza motriz está suministrada por un motor de nafta de 4 cilindros con refrigeración de agua, de 30 H.P. efectivos, acoplado directamente a una dínamo que genera corriente a la tensión de 100 Vts. cuando marche a 2000 r.p.m. Un motor solo efectua las operaciones de elevación de la carga y desplazamiento del pescante. Este motor es del tipo completamente cerrado con arrollamiento compound, mientras que la fuerza motriz para la traslación está provista por un segundo motor con arrollamiento en serie. La conducción de la grúa es obtenida mediante un volante ordinario, cuyo movimiento se transmite a las ruedas traseras por engranages cilíndricos con dientes cortadas a máquina. Todas las ruedas giran en cojinetes de bolas y tienen llantas de goma. Los grupos que transmiten la fuerza motriz para la elevación y el desplazamiento consisten de tambores ranurados de gran diámetro movidos por un motor a traves de embragues y engranages cilíndricos. Todos los órganos de maniobra son de fácil alcance para el conductor, cuyo asiento está colocado de modo que tenga libre campo visual en todas las direcciones.

La excelente capacidad de movilidad de esta grúa puede ser deducida de la Fig. 23 que muestra las varias posiciones en las que pueden colocarse las ruedas. Se verá que dicha grúa puede entrar en rincones y alrededor de obstáculos con suma facilidad.

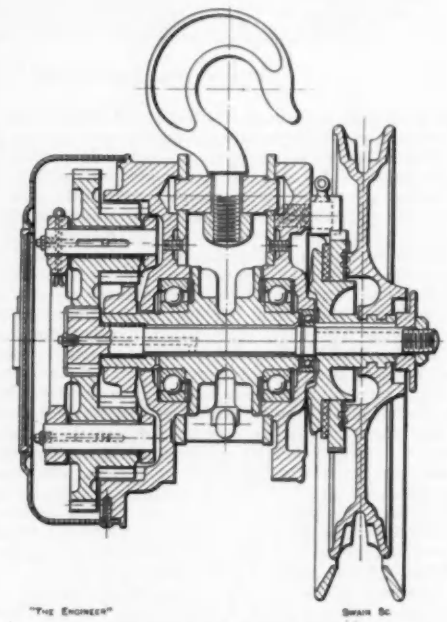


FIG. 24—PULLEY BLOCK—MORRIS

La Fig. 24 muestra una sección del polipasto perfeccionado Morris con cojinete de bolas. Se notará que todas sus partes destinadas a sostener grandes esfurzos están soportadas por cojinetes de este tipo, obteniéndose así un gran rendimiento. La transmisión es efectuada desde la rueda para cadena de mano, que se encuentra a la derecha, a lo largo del eje central hasta un piñon colocado en el otro extremo que acciona dos engranages intermedios, los que a su vez accionan la rueda de la cadena de la carga principal. El eje central gira en cojinetes de bolas y la cadena de la carga está igualmente sostenida en el bastidor principal. Las ruedas intermedias cuyo empuje está compensado estan muy ligera-

mente cargadas y tienen por lo tanto cojinetes de tipo ordinario. La lubrificación de los cojinetes se efectua abriendo una tapa bien ajustada que cubre los engranages. En esta forma es posible alcanzar facilmente los tres nipples. Los exteriores conducen la grasa desde la bomba engrasadora hasta los cojinetes de las ruedas intermedias, y el del centro alimenta todos los cojinetes que sostienen a la carga. Las tapas de los engranages estan dispuestas de forma que impidan la entrada de materias extrañas y polvo en los cojinetes y en las ruedas. El freno funciona automáticamente y no presenta ninguna resistencia a la elevación; el guardacadenas está

FIG. 25—T.S.S. "TEUCER"—HAWTHORN, LESLIE

construido en modo que pueda proporcionar una tracción suave y uniforme desde cualquier posición.

R. AND W. HAWTHORN, LESLIE AND CO.

R. and W. Hawthorn, Leslie and Co., Ltd., of Hebburn-on-Tyne, are exhibiting a number of models of vessels constructed by them. Warships are represented by H.M. light cruiser "Champion," of 1914, and H.M. flotilla leader "Montrose," of 1918. The first of these has a displacement of 4657 tons and is armed with three 6in. guns, four 4in. Mark V. and one 3in. A.A., and a number of torpedo tubes. She is driven by all-geared Parsons turbines of 40,000 S.H.P. on two shafts and is fitted with six Yarrow boilers oil fired. Her speed is 29½ knots. She was the first vessel of her class to be fitted with twin-screw geared turbine propelling machinery, which proved so successful that the Admiralty decided to install the same type in subsequently constructed vessels. The "Champion" took part in the Battle of Jutland and was refitted in 1924–5.

The class of flotilla leaders represented by H.M.S. "Montrose" constituted a considerable advance in design at the time they were built; they are armed with five 4·7in. B.L. guns and six torpedo tubes, and have a displacement of 1996 tons and a speed of 35 knots.

Fig. 25 illustrates the t.s.s. "Teucer," of which a model is exhibited. She has a deadweight of 13,100 tons and a draught of 30ft. 9in., and is propelled by triple-expansion engines on two shafts with a S.H.P. of 5000. She was built for Alfred Holt, Ltd., for the Blue Funnel Line and has a speed of 14 knots.

The model of the t.s.s. "Bosphorus" illustrates a vessel designed for passenger service on the Bosphorus and the Sea of Marmora.

The models have been made to show how wide a range of work is turned out at the Hebburn shipyard. A number of photographs illustrate other interesting ships and several types of locomotives constructed for railways in various parts of the world.

Los Sres. R. and W. Hawthorn, Leslie and Co., Ltd., de Hebburn-on-Tyne, exhiben cierto número de modelos de buques construidos en sus astilleros. Los buques de guerra están representados por el crucero ligero inglés, "Champion" del año 1914, y el destructor "Montrose" tambien de la Marina Británica, del año 1918. El primero tiene un desplazamiento de 4657 toneladas, y está armado con tres cañones de 6 pulg., cuatro Mark V. de 4 pulg., y un A.A. de 3 pulg., además de varios tubos lanza-torpedos. Tiene propulsión por turbinas Parsons con engrenajes de 40,000 caballos-eje montadas sobre dos ejes, y alimentadas por seis calderas Yarrow, que queman combustible líquido. Su velocidad de marcha es 29½ nudos. Fué el primer buque en su clase provisto con propulsión por turbina engranada de dos hélices, sistema que dío tan buenos resultados que el Almirantazgo decidío instalarlo en los buques construidos sucesivamente. El "Champion" tomó parte en la batalla de "Jutland" y fué recondicionado en 1924–5.

La clase de destructores a la que pertenece el "Montrose" fué un adelanto importante en construcción naval en la época en que fueron construidos; están armados con cinco cañones B.L. de 4·7 pul., y seis tubos lanza-torpedos y tienen un desplazamiento de 1996 toneladas y una velocidad de 35 nudos.

La Fig. 25 representa el vapor "Teucer" de dos hélices, del que se exhibe un modelo. Tiene un peso muerto de 13,000 toneladas, y un calado de 30 piés 9 pulg. [9·4 m.] Sus máquinas propulsoras son de triple expansión montadas sobre dos ejes y desarollan 5000 caballos-eje. Fué construido para Alfred Holt, Ltd., para la Blue Funnel Line y tiene una velocidad de 14 nudos.

El modelo del vapor "Bosphorus" de dos hélices representa un buque construido para el servicio de pasajeros en el Bósforo y en el Mar de Mármora.

Los modelos han sido construidos para demostrar la gran variedad de construcciones ejecutadas por los astilleros de Hebburn. En una serie de fotografías se ilustran otros buques interesantes así como varios tipos de locomotoras construidas para compañias ferroviarias en diversas partes del mundo.

W. H. ALLEN, SONS AND CO., LTD.

The lightweight single-acting airless-injection engine of which we reproduce a photograph, Fig. 26, first put on the market by the firm a year ago, is an exhibit of considerable interest by W. H. Allen, Sons and Co., Ltd. It is a very compact unit designed for either land or marine work. On the stand it is shown equipped for a belt drive, but it can, of course, be coupled to an electric generator or a centrifugal pump, and can be adapted for other forms of drive. The cylinder bore is 230 mm., with a stroke of 300 mm., and the designed piston speed is 5 m. at a speed of 500 revolutions per minute. All the engine controls, pressure gauges, fuel and lubrication filters, and a fuel heater are arranged at the end of the engine furthest from the fly-wheel. Pyrometers are fitted to each exhaust outlet. The fuel consumption figures of the engine, as obtained during extensive trials, are given to us as follows:—Full load, 0·39 lb.; three-quarter load, 0·39 lb.; half-load, 0·42 lb.; and one-quarter load, 0·54 lb. of oil per B.H.P. hour. Interesting points in the design are the neat way in which the top of the liner is secured to the cylinder head, so that ample cooling water space can be provided around the combustion space; the increased cooling effected by this means results in higher mean effective pressures being attainable, and therefore in ability to take greater overloads. The cylinder tops are enclosed by light aluminium cases which can be rapidly removed for inspection of the running gear. Particular care has been devoted to the design of the crank shaft, which is dimensioned in such a manner that the complete range of running speeds is well below the main critical speeds with any grouping of cylinders. It is of the solid forged type.

A useful provision is a charging valve on the cylinder head nearest the fly-wheel, which is released by screwing down a hand wheel. The fuel pump supplying oil to that cylinder is then cut out of action, and the cylinder can be used for compressing the starting air.

Besides this engine, the firm is exhibiting two Allen "Conqueror" pumps of standard design for use with belt drives.

La Fig. 26 muestra una fotografía del motor ligero de simple efecto sin inyección de aire, lanzado al mercado por primera vez, hace un año, por sus constructores y que representa un producto muy interesante de la Casa W. H. Allen, Sons and Co., Ltd. Este motor forma un grupo muy compacto y puede ser construido para uso terrestre o marino. Tal como está expuesto en su Stand, tiene transmisión por correa, pero naturalmente puede ser acoplado a un generador eléctrico o a una bomba centrífuga y adaptado a otros sistemas de transmisión. El diámetro interior del cilindro es de 230 mm., la carrera de 300 mm. y las velocidad teórica del émbolo es de 5 metros cuando el motor marche a 500 r.p.m. Todos los aparatos de maniobra del motor, los manometros, filtros del combustible y del aceite de lubrificación y el calentador del combustible están dispuestos en el extremo del motor más distante del volante. Cada orificio de escape está provisto de pirómetro. Según nos informan, el consumo de combustible de este motor, determinado despues de ensayos muy extensos, es el siguiente:—Carga 100%, 0·39 lib. [·18 kilo.]; Carga 75%, 0·39 lib. [·18 kilo.]; Carga 50%, 0·42 lib. [·19 kilo]; Carga 25%, 0·54 lib. [·24 kilo.], de aceite por H.P. efectivo/hora. Una de las características más interesantes de este motor es la forma elegante en que la parte superior de la camisa está sujetada a la cabeza del cilindro, de forma que deja un amplio espacio para el agua de refrigeración alrededor de la cámara de combustión; el aumento de refrigeración que se consigue en esta forma permite obtener presiones medias efectivas más altas y por lo tanto la posibilidad de trabajar con sobrecargas superiores. Las culatas de los cilindros están encerradas en cajas de aluminio ligero, pueden ser facilmente desmontadas para la inspección del mecanismo. El eje cigüeñal, a cuya construcción se ha dedicado un estudio especial,

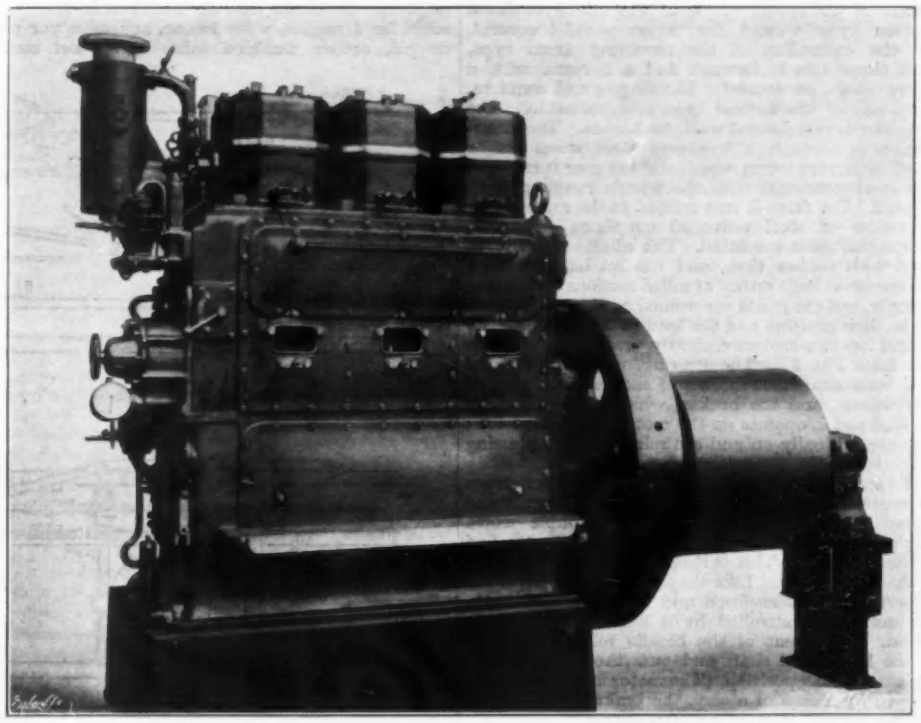


FIG. 26—100 H.P. HIGH-SPEED OIL ENGINE—ALLEN

tiene dimensiones tales que la serie completa de velocidades de marcha es considerablemente inferior a las velocidades críticas principales en cualquier grupo de cilindros. Dicho cigüeñal es del tipo forjado macizo.

Otra característica importante consiste en la válvula de carga que se encuentra en la cabeza del cilindro más próximo al volante y puede ser librada haciendo girar un pequeño volante; entonces la bomba de combustible, que suministra el aceite a tal cilindro, queda fuera de acción y el cilindro puede ser usado para comprimir el aire de arranque.

Además de este motor, dicha firma exhibe dos bombas Allen "Conqueror" de tipo normal con transmisión por correa.

GREENWOOD AND BATLEY, LTD.

An elevating platform truck makes an interesting exhibit on the stand of Greenwood and Batley, Ltd., of Leeds. This truck is capable of elevating a load

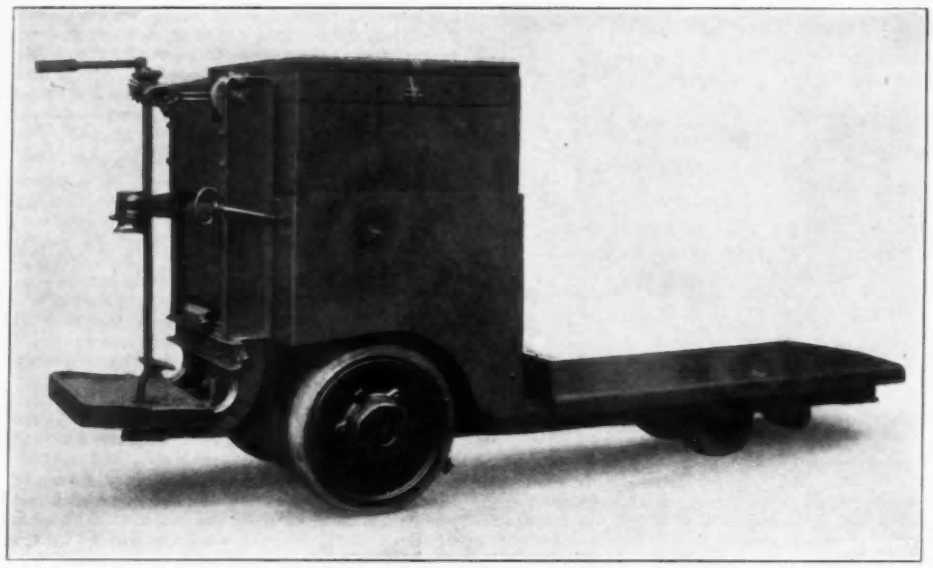


FIG. 27—ELEVATING PLATFORM TRUCK—GREENWOOD

of 2 tons in 5 seconds and can run between 15 and 20 miles on one battery charge. The lift of the platform is 4in., it is 5ft. long and 2ft. 2in. wide. The speed of the truck with a full load is 5 miles per hour.

The motor for driving the truck is made by the makers of the truck. It is of the totally enclosed traction type wound for series parallel control, and the controller, of the revolving drum type, gives three speeds forward and a reverse, with a spring return to neutral. The fingers and contacts, which are of the normal type, are renewable. The controller is interlocked with the brakes. The transmission is through a hardened steel worm on to phosphor bronze worm wheel, and the gear is enclosed in a steel gear case with the wheels running in an oil bath. The drive is transmitted to the road wheels by means of steel universal couplings and rods. Differential gears are fitted. The wheels are of steel, fitted with rubber tires, and run on ball bearings. The chassis is built up out of rolled sections and braced strongly, and the joints are welded or riveted, according to their position and the load to be carried. The control handles are conveniently arranged, as can be seen from Fig. 27. The steering, which is operated by a horizontal tiller motion of the handle, turns all four wheels, and the brakes, which are applied by the foot pedal, operate on the motor shaft extension; they are normally on and are released by depressing the pedal.

The machinery for elevating the platform comprises a Greenwood and Batley totally enclosed compound wound motor connected through a double worm reduction gearing to a crank arm. This arm is attached to the platform, which is itself carried on links fixed to the main frame. Like that of the main drive, the reduction gear is enclosed and runs in an oil bath. The action is controlled by a handle conveniently placed. Movement of the handle releases a brake on the high-speed shaft and puts the motor switch into the running position. The motor is automatically stopped by means of a cam, the brake being applied and the current shut off simultaneously.

Other interesting exhibits on the stand are a re-seating tool, which will true up valve seatings without it being necessary to remove the valves from the pipe line in which they are fixed; a cold heading machine for making rivets, tire studs, balls, &c., at a rapid rate, and a 10 kW steam turbine dynamo.

Una zorra con plataforma elevadora forma uno de los artículos interesantes expuestos en el estante de Greenwood y Batley, Ltda., de Leeds. Esta zorra puede elevar una carga de 2 toneladas en 5 segundos y puede correr a entre 15 y 20 mil. por hora [24–32 km.] con una carga de batería. La alzada de la plataforma es 4″ [100 mm.], y mide 5′ [1·5 m.] de largo por 2′ 2″ [·65 m.] de ancho. La velocidad de la zorra es 5 mil. [8 km.] por hora con carga completa.

El motor para mover la zorra es fabricado por los fabricantes de la zorra. Es del tipo completamente cerrado de tracción, con enrollado para control en paralelo y séries, y el reóstato, del tipo de cilindro giratorio dando tres velocidades adelante y una atrás, con un retorno a resorte a neutral. Las lengüetas y contactos del tipo normal, son renovables. El reóstato está interconectado con los frenos. La transmisión es por medio de un sin fin de acero endurecido que manda una rueda helizoidal de bronce fosforoso, y los engranages van encerrados en un carter de acero en el que las partes se mueven en un baño de aceite. El esfuerzo se transmite a las ruedas por medio de juntas universales y varillas de acero. Se suministra engranages diferenciales. Las ruedas son de acero, con llantas de caucho, y giran sobre cojinetes de bolillas. El bastidor está hecho de secciones laminadas y unido sólidamente, las juntas van soldadas o remachadas, según la posición y la carga que deban llevar. Las manijas de control están arregladas convenientemente, como se ve en la Fig. 27. El gobierno, que tiene lugar por un brazo de timón movido horizontalmente, actúa sobre las 4 ruedas, y los frenos, aplicados por pedal de pié, actúan también sobre el eje del motor; normalmenete están adjustados y se les afloja pisando en el pedal.

La maquinaria para elevar la plataforma comprende un motor de Greenwood y Batley totalmente cerrado, del tipo de bobinado compuesto, conectado por un sin fin doble de reducción a un árbol de manivelas. Est árbol está afirmado a la plataforma, la que a su vez va soportada por brazos fijos en el armazón principal. Lo mismo que la transmisión principal, el engranage de reducción va encerrado y trabaja en un baño de aceite. La acción va controlada por una manija colocada convenientemente. El movimiento de la manija afloja un freno del eje de alta velocidad y pone el reóstato del motor en la posición de marcha. El motor es detenido automáticamente por medio de una leva, y el freno actúa y la corriente se corta automáticamente, simultáneamente.

Otros artículos expuestos interesantes en el escaparate son un aparato para reasentar, que ajustará asientos de válvulas sin que sea necesario sacar las mismas de la cañería en que estén colocadas; una roblonadora en frío para hacer remaches comunes, para llantas neumáticas, pelotas, etc., a gran velocidad, y una turbina dinamo a vapor de 10 kW.

THE VACUUM BRAKE COMPANY, LTD.

The exhibit of the Vacuum Brake Company, Ltd., of London, in conjunction with its associated concerns of Gresham and Craven, Ltd., of Manchester, and the Heatly-Gresham Engineering Company, Ltd., of Letchworth, consists of a full range of vacuum brake equipment for all kinds of railway locomotives and railcars, and rolling stock. Besides a working model of a brake, signal horn and sanding equipment, the most interesting mechanisms on the stand are those forming a range of "Dreadnought" ejectors, and a two-power vacuum automatic brake equipment. The modified Gresham "Dreadnought" ejector is interchangeable with the older type made by the firm, and the same parts are used in both, with only two exceptions. The new parts are the cones and the small back stop valve between the large and small ejectors. The makers claim that the new cones effect considerable economies in the steam consumption, while maintenance costs are reduced and the overall efficiency increased at the same time. All parts are now screwed solidly up to shoulders, with the result that parallel joints which are always a source of trouble have been eliminated. The new cones are very simple in construction, and do not need delicate adjustment in order to attain the highest efficiency. This ejector is also fitted with redesigned vacuum and reducing valves, which, however, are interchangeable with the older forms. The reducing valve has been so designed that it cannot open until a predetermined vacuum is reached, while the release valve, having larger passages, acts more rapidly. It also returns to its seat automatically. The ejectors are 20 mm. and 30 mm. in diameter respectively, and the makers consider that this is the largest combination which can be used satisfactorily on a 2in. train pipe. The arrangement of a two-power brake on a four-wheeled wagon is shown in Fig. 28. This brake has been designed to meet the brake requirements of light vehicles capable of carrying heavy loads. Two standard brake cylinders are fitted to the wagon, the vacuum chambers of which are connected up through a timing valve by flexible pipe connections. The train pipe branch of the light load cylinder is connected directly to the train pipe, but that of the heavy load cylinder is connected to it through the timing valve. It will be seen that a

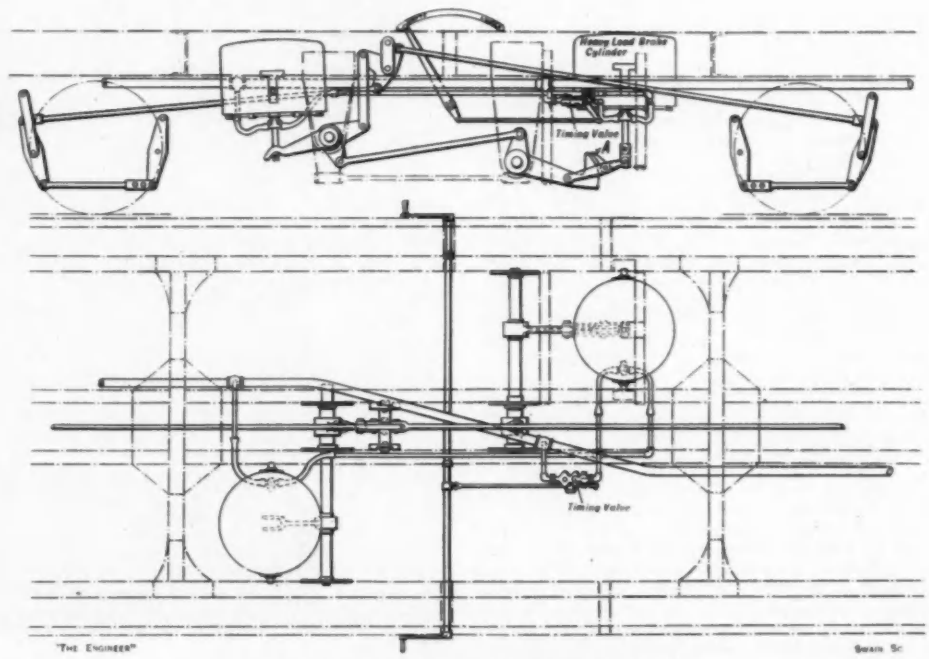


FIG. 28—TWO-POWER BRAKE ARRANGEMENT—VACUUM

lever is attached to the timing valve. When the truck is empty, this lever is put into the "empty" position, which causes both the connections to the heavy load brake cylinder to be closed, isolating this cylinder from the braking system. When the brake is applied the light load cylinder only takes effect, acting on the brake shoes through a series of levers with a normal leverage of 8 to 1. As the ratchet arrangement below the heavy load cylinder is out of contact, the movement of the levers has no effect upon the heavy load cylinder. When the brake

handle is put into the "loaded" position both cylinders are connected to the train pipe. When the brake is applied air enters the light load cylinder in the normal manner, but the action is delayed by the timing valve in the case of the heavy load cylinder. In consequence the brake blocks have been applied to the wheels and the rack has been raised before the heavy load cylinder takes effect. As soon as the second cylinder piston starts to move the pawl A is dropped into the ratchet, and the combined power of both cylinders is applied to the brake shoes. On releasing the brake the air is exhausted without hindrance from both cylinders, and both the pistons descend together until the tail of the link carrying the pawl comes into contact with a stop piece, lifting the pawl from the rack, and enabling the piston of the light load cylinder to descend still further. The teeth on the rack are radial about the pin on which the pawl works, and the face of the pawl is designed in the same manner in order to avoid the possibility of the load being transmitted by the points of the teeth alone. Fig. 29 shows sections through the timing valve. The two branches at the top of the valve X and Y are connected to the upper sides of the two brake cylinders, so that chamber Z is under vacuum. Branch V is connected to the train pipe and the branch W to the bottom of the second cylinder through a double branch release valve. Valve T allows air to be drawn freely from the second cylinder, but prevents air reaching it during brake application. When the brake is applied air admitted to the train pipe can pass through passage S to the chamber R. The timing valve is controlled by the diaphragms

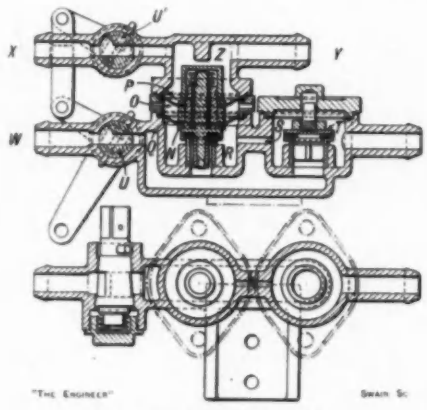


FIG. 29—TIMING VALVE—VACUUM

P and Q. Diaphragm P pulls the valve upward, owing to the difference of pressure between the vacuum in chamber Z and the atmosphere in chamber O, while the diaphragm Q exerts a downward pull owing to the difference in pressure between the train pipe vacuum in chamber R and the atmosphere in chamber O. The downward pressure on the valve therefore varies with the train pipe vacuum. Diaphragm Q has a slightly greater effective area than diaphragm P; hence with the brake in the release position there is a definite pressure tending to close the valve. It will be seen therefore that air cannot pass through the valve to work the heavy load brake cylinder until the vacuum in chamber R has been reduced sufficiently to balance the greater area of the diaphragm Q. Thus the action of the second brake cylinder is delayed until the first cylinder has applied the brake shoes to the wheels and brought the rack into position for the pawl to engage with it.

Lo expuesto por la Compañia de Frenos Neumáticos Ltda., de Londres, en conjunto con Gresham and Craven, Ltda., de Manchester, y la Heatly-Gresham Engineering Company, Ltd., de Letchworth, consiste en un variado surtido de juegos de frenos neumáticos para toda clase de locomotoras de ferrocarril coches automotores y material rodante. Además del modelo activo de un freno, bocina de señales y mecanismo de echar arena, los mas interesantes aparatos son en este stand los que forman el surtido de eyectores "Dreadnought" y el equipo de freno al vacío automático de doble poder. El "Dreadnought" modificado de Gresham es intercambiable con el tipo antiguo hecho por la casa, y las mismas partes usadas en ambos, con excepción de dos solamente. Las partes nuevas son los conos y la pequeña válvula trasera de retención entre los eyectores pequeños y los grandes. Los fabricantes consideran que los conos nuevos efectúan gran economía en el gasto de vapor, y los gastos de mantenimiento se reducen y al mismo tiempo se aumenta la eficiencia total. Todas las partes van ahora sólidamente atornilladas a unos rebordes, con el resultado de eliminarse las juntas paralelas que eran siempre un motivo de molestias. Los conos nuevos son de construcción simple, y no exijen ajustes muy delicados para dar el máximo resultado. Este eyector va también provisto de válvulas de vacío y reducción diseñadas de nuevo, las que sin embargo, son intercambiables con las formas anteriores. La válvula de reducción ha sido proyectada de tal manera que no puede abrir mientras un cierto vacío determinado no haya sido producido, en tanto que la válvula de descarga, que tieene mas amplios pasages, actúa mas rápidamente. También vuelve a su asiento automáticamente. Los eyectores tienen 20 mm. y 30 mm. de diámetro respectivamente, y los fabricantes consideran que esta es la combinación mas grande que puede usarse satisfactoriamente con tubería de tren de 2" [50 mm.]. El arreglo del freno de doble acción para un wagón de 4 ruedas se ve en la Fig. 28. Este freno ha sido proyectado para llenar las exijencias de los frenos de vehículos livianos capaces de llevar cargas pesadas. Se coloca dos cilindros normales de freno por wagón, cuyas cámaras de vacío estàn conectadas por medio de una válvula reguladora y conexiones de caño flexible. La rama del tubo del tren del cilindro de poca carga está conectada directamente al tubo del tren, pero la del cilindro de carga pesada está conectada con él por intermedio de la válvula reguladora. Se verá que hay una palanca unida a la válvula reguladora. Cuando el wagón está vacío, esta palanca se pone en "vacío," lo que causa el cierre de las dos conexiones del cilindro de carga pesada, aislando este cilindro del sistema de frenaje. Cuando se aplica el freno solo actúa el cilindro de carga liviana, por su acción sobre los patines del freno por intermedio de una série de palancas cuya relación normal es de 8 a 1. Como el mecanismo de retén bajo el cilindro de carga pesada está fuera de acción, el movimiento de las palancas no tiene efecto alguno sobre el tal cilindro. Cuando la manija del freno se pone en la posición "cargada" ambos cilindros están unidos al tubo del tren. Cuando se aplica el freno entra aire en el cilindro de carga liviana de la manera normal, pero la acción es retardada por la vàlvula reguladora en el caso del cilindro de carga pesada. En consecuencia los bloques de los patines han sido ajustados

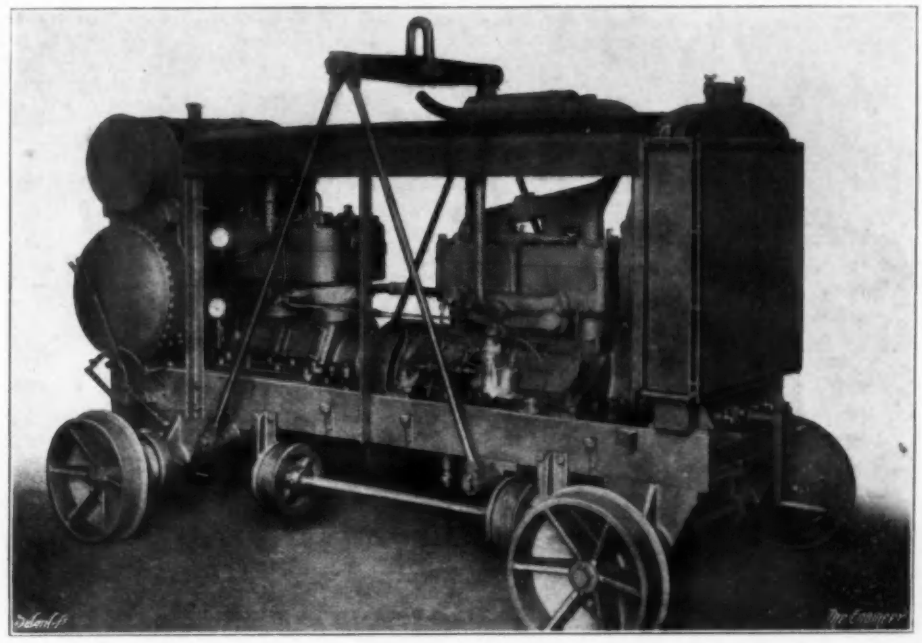


FIG. 30—PETROL-DRIVEN AIR COMPRESSOR—HOLMAN

contra las ruedas y la cremallera levantada antes de que el cilindro de carga pesada empiece a actuar. Encuanto el pistón del segundo cilindro empieza a moverse el crique A cae en su trinquete, y entonces se aplica a los patines el esfuerzo combinado de ambos cilindros. Al soltar el freno el aire se escapa sin estorbo alguno de los dos cilindros, y ambos pistones descienden juntos hasta que el extremo del brazo que tiene crique llega al sitio del retén, levantando la garra de la cremallera, y permitiendo al pistón del cilindro de carga liviana bajar todavía mas. Los dientes en la cremallera son radiales con respecto a los pernos en que el trinquete actúa, y la cara de la garra está hecha la misma manera para evitar la posibilidad de que la carga se transmita por los extremos de los dientes solamente. La Fig. 29 muestra secciones a través de la válvula reguladora. Los dos ramales en el tope de la misma X y Y están unidos a los lados de arriba de los cilindros de vacío de manera que la cámara Z está siempre en vacío. La rama V va unida al caño o tubo del tren y la rama W al fondo del segundo cilindro por medio de una válvula de escape de doble vía. La válvula T permite la absorción fácil de aire del segundo cilindro, pero evita la llegada del mismo a él durante la frenada. Cuando se frena el aire admitido en el tubo del tren puede pasar por el pasaje S a la cámara R. La válvula reguladora está controlada por los diafragmas P y Q. El diafragma P tira la válvula hacia arriba, debido a la diferencia de presión entre el vacío entre la cámara Z y la atmósfera en la cámara O, entanto que el diafragma Q efectúa una presión hacia abajo debido a la diferencia de presión entre el tubo del tren y su vacío en la cámara R y la atmósfera en la cámara O. La presión hacia abajo en la válvula varía por consiguiente con el vacío en el caño o tubo del tren. El diafragma Q tiene una área efectiva algo mayor que la del diafragma P; de ahí que el freno en la posición de aflojar ocasiona una presión definida tendiente a cerrar la válvula. Se notará pués que el aire no puede pasar por la válvula para operar en el cilindro de carga pesada hasta que el vacío en la cámara R haya sido reducido suficientemente para equilibrar la mayor área del diafragma Q. Así la acción del segundo cilindro de freno se retarda hasta que el primer cilindro haya aplicado los patines del freno a las ruedas y traído la cremallera a la posición en que la garra engrane con ella.

HOLMAN BROTHERS, LTD.

The exhibits of Holman Brothers, Ltd., of Camborne, Cornwall, are representative of the wide variety of their products for pneumatic plant. The petrol-driven portable air compressor, of which we reproduce a photograph, Fig. 30, is a standard single-stage duplex type machine having a capacity of 160 cubic feet per minute. This set is to be used for railway work after the Exhibition closes, and it is therefore fitted with flanged wheels. Traversing wheels for derailing and a lifting bale are also included.

A description of a Hele-Shaw Beacham air motor similar to that which the firm is showing was given in our issue for September 27th, 1929. For this Exhibition holes have been cut in the outer casing of one of these motors to show the interior mechanism. The machine is the smallest of the range that Holman Brothers produce. It develops 4 H.P. at 1500 r.p.m. with an air pressure of 80 lb. per square inch. These motors have a very high starting torque and are very adaptable for haulage work. Where no electric current is available, or where, for the sake of safety, air is preferred, they take the place of electric motors. A large number of pneumatic tools are also shown, including a 50 lb. rock drill, two pneumatic rippers, air drills, riveting and chipping hammers, and a hand drill. The makers claim that the latter, known as the S.L.B., is unusually easy to handle owing to its symmetrical outline and balance. Symmetry is obtained by removing the main distributing valve base to the rear end of the cylinder instead of placing it on the side.

El muestrario de los Sres. Holman Hermanos, Ltda., de Camborne, en Cornwall, representa el variado surtido y variedad de sus productos para instalaciones neumáticas. El compresor de aire portátil accionado por motor de petróleo, del que mostramos una fotografía Fig. 30, es una máquina normal de una etapa tipo doble de una capacidad de 160 piés cúb. p. min. [4·5 m.³]. Este juego será usado para trabajo ferrocarrilero después de la Exposición, y por eso tiene ruedas de pestañas. Ruedas para desplazamiento lateral para salir de los rieles y gatos para levantar van también incluidas.

Una descripción de un motor de aire Hele-Shaw Beacham similar al que la firma expone, apareció en nuestro número de septiembre 27 de 1929. Se ha hecho unos agujeros en los lados de un motor para mostrar el interior de los mismos al público de la Exposición. La máquina es la mas pequeña de la lista que producen los Hermanos Holman. Desarrolla 4 H.P. a 1500 vueltas por minuto con una presión de aire de 80 lib. p. pulg. cuad. [5·4 m.³]. Estos motores tienen un par de fuerza de arranque muy poderoso y se adaptan bién a trabajo de tiro pesado. Endonde no se pueda obtener electricidad, o endonde por razones de seguridad, se prefiera aire, estos motores ocupan el lugar de los eléctricos. Un gran número de herramientas neumáticas están a la vista, incluyendo una perforadora para roca de 50 lib. [22·7 kilo.], dos picos neumáticos, perforadores neumáticos, martillos

de remachar y picadores, y un taladro de mano.

Los fabricantes sostienen que este último, llamado el S.L.B. es extraordinariamente fácil de manejar debido a su perfil simétrico y equilibrado. Se obtiene simetría sacando la base de la válvula principal de distribución y poniéndola en el extremo de atrás del cilindro en lugar de colocarla en uno de los lados.

FODENS, LTD.

Fodens, Ltd., of Sandbach, Cheshire, some of whose products are already well known in South America, are exhibiting two six-wheel steam wagons and a tractor. The lighter wagon is known as the Speed-Six. It is fitted with pneumatic tires and has a carrying capacity of 6 tons and is capable of hauling a trailer carrying a further 6 tons. The platform area is 15ft. by 6ft. 9in. The wagon has two axles, there being two wheels on the front and four on the rear. The engine, which works on simple expansion in two cylinders, 5in. in diameter with a 7in. stroke, is placed transversely across the frame, and its valves, of the poppet type, are actuated by cam shafts. The wagon is fitted with a two-speed gear-box and the drive is carried from this point to the rear axle

Los Sres. Fodens, Ltda., de Sandbach en Cheshire, algunos de cuyos productos son ya conocidos en Sud América, exponen dos camiones de seis ruedas, de vapor, y un tractor. El camión mas liviano se llama Speed-Six (Seis-Rápido). Va provisto de llantas neumáticas y tiene una capacidad de carga de 6 toneladas y es capaz además de remolcar otro carro con 6 toneladas mas. La superficie de la plataforma es de 15′ por 6′ 9″ [4·6 m. × 2 m.]. El camión tiene dos ejes, con dos ruedas delanteras y cuatro traseras. El motor, que trabaja por simple expansión en dos cilindros, de 5″ de alma por 7″ de carrera [127 mm. × 178 mm.] va colocado a través del chassis, y sus válvulas del tipo de vástago, van mandadas por árboles de levas. El camión tiene una caja de dos velocidades y la transmisión se efectúa desde este punto al eje trasero por un cardán y tornillo sin fin. Tanto el cigüeñal como los engranages están completamente encerrados y funcionan en baños de aceite. El enaceitado por todas partes se efectúa por medio de una bomba mecánica. El motor está calculado para producir 80 H.P. a 500 vueltas por minuto.

La caldera ha sido diseñada para dar vapor a una presión de 275 lib. p. pulg. cuad. [19 at]. Es del

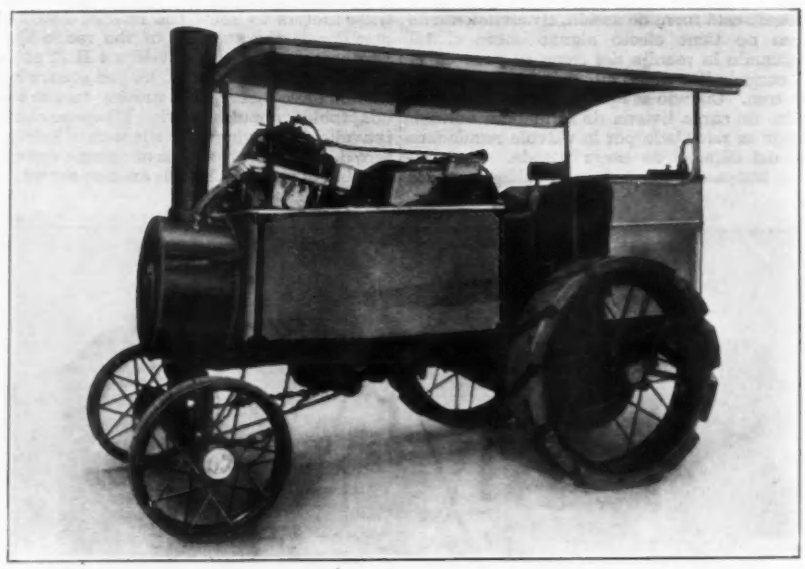


FIG. 31—STEAM TRACTOR—FODENS

by a cardan shaft and worm. Both the crank shaft and the gears are completely enclosed, and run in oil baths. Lubrication throughout is accomplished by means of a power pump. The engine is rated to give 80 B.H.P. at 500 r.p.m.

The boiler is designed to give steam at a pressure of 275 lb. per square inch. It is of the horizontal water-tube type, with a grate area of 3·68 square feet. The fuel consumption is given as 25–30 miles per cwt. of best Welsh coal.

The wagon is provided with a water tank of 168 gallons capacity. Four-wheel brakes are fitted and are operated by a steam cylinder, the action of which is controlled by a foot pedal. There is also a foot pedal brake acting on the rear wheels only.

The makers claim that the wagon is capable of maintaining an average speed of 20 m.p.h., and that higher speeds are possible when no trailer is attached.

The larger wagon, known as the Speed-Twelve, is designed on the same lines as the Speed-Six, but carries loads of 12 tons. Its platform is 20ft. in length by 6ft. 9in. in width. A larger water storage tank and more powerful brakes are provided. The consumption is given as 20–25 miles per cwt. of best Welsh coal. The machine is covered by a twelve months' guarantee.

The steam tractor, of which we reproduce a photograph—Fig. 31—is capable of ploughing between 8 and 10 acres a day with a three-furrow plough, 12in. deep, at an average speed of 5 m.p.h. It can also be used for stationary driving purposes. The engine, which is situated immediately above the boiler, has two double-acting cylinders, 5in. in diameter with a 7in. stroke. Steam is distributed by poppet valves, operated by a cam shaft, which can be moved horizontally to give three different cut-offs for forward motion and a reverse and stop. The crank shaft runs on roller bearings. The transmission is through a two-speed gear and a roller chain to an enclosed differential on the back axle. The water-tube boiler has a working pressure of 250 lb. per square inch, with a total heating surface, fire-box and tubes, of 85·6 square feet, and a grate area of 3·68 square feet. The outer shell and the fire-box are made in two portions coupled by flanges. When the flanges are uncoupled the fire-box and tubes can be disconnected and drawn out. The feed is supplied by a pump driven by a chain from the crank shaft, and an injector is also fitted.

The wheels of this tractor are so made that rubber tires can be bolted to them for use on hard roads, and a powerful band brake is fitted on the rear axle, and operated either by a foot pedal or a hand lever. This machine is also covered by a guarantee.

tipo de tubos de agua horizontales, con una superficie de rejilla de 3·68 piés cuad. [·34 m.²]. El consumo de combustible se da como de 25–30 millas por quintal [·8–·95 km. p. kilo.] del mejor carbón de Gales.

El camión tiene un tanque de agua de 168 galones [·77 m.³] de capacidad. Tiene frenos en las 4 ruedas operados por un cilindro de vapor cuya acción está gobernada por un pedal de pié. También tiene un pedal de pié para actuar sobre las ruedas traseras solamente.

Los fabricantes afirman que el camión es capaz de mantener una velocidad media de 20 millas por hora [32 km.], y que se puede andar mucho mas ligero cuando se le usa sin remolques.

El camión mas grande, llamado Speed-Twelve (Doce-Rápido) está proyectado en las mismas líneas del Seis-Rápido, pero lleva una carga de 12 toneladas. Su plataforma tiene 20′ de largo por 6′ 9″ de ancho [6 m. × 2m.]. Tiene también un tanque mayor para agua y frenos mas potentes. El consumo se da como de 20–25 mill. p. quintal inglés [·63–·8 km. p. kilo.] del mejor carbón de Gales. El motor está garantizado por doce meses.

El tractor de vapor, cuya fotografía reproducimos —Fig. 31—es capaz de arar de 8 a 10 acres [3·2–4 Ha], por dia con un arado de tres rejas de 12″ [·3 m.] de hondura a un promedio de 5 mill. p. hora [8 km.]. Puede utilizarse también para uso estacionario. El motor, que está colocado inmediatamente encima de la caldera, tiene dos cilindros activos de doble efecto de 5″ de alma y 7″ de carrera [127 × 178 mm]. El vapor va distribuido por válvulas de vástagos mandadas por un eje de levas, el que puede desplazarse lateralmente, horizontalmente, para permitir tres velocidades para marcha adelante y para dar marcha atrás y parar. El cigüeñal gira en cojinetes de rodillos. La transmisión tiene lugar por medio de un engranage de dos velocidades y una cadena de rolletes a un diferencial protegido que va sobre el eje trasero. La caldera de tubos de agua tiene una presión de trabajo de 250 lib. p. pulg. cuad. [17 at.], con una superficie de calefacción, caja de fuego y tubos de 85·6 piés cuad. [8 m.²], y un área de parilla de 3·68 piés cuad [·34m.²]. El forro externo y la caja de fuego están hechas de dos partes unidas por bridas. Cuando las bridas se aflojan, la caja de fuego y los tubos pueden desconectarse y sacarse. La alimentación se produce por una bomba mandada por una cadena desde el cigüeñal, y también se provée de un inyector. Las ruedas de este tractor están hechas de tal modo que se les puede agregar llantas de caucho para usarlas en calles duras, y un freno poderoso de cinta va en el eje trasero, el que puede actuar por pedal de pié o por palanca de mano. Esta máquina está también protegida o cubierta por garantía.

THE GENERAL ELECTRIC COMPANY.

Industrial engineering products and lighting and domestic appliances are being exhibited by the General Electric Company, of Witton, Birmingham. Standard D.C. and A.C. motors, with control gear, a 200-ampère D.C. high-speed circuit breaker, a 200-ampère line contact circuit breaker, a traction motor and controller as supplied to the Buenos Aires Central Terminal Railway, and a collection of transformers constitute the industrial engineering exhibits; whilst larger plant manufactured by the company is represented by photographs. Besides electric domestic and lighting appliances of many kinds, the company is showing wireless apparatus and railway signalling apparatus, manufactured by the Siemens and General Railway Signalling Company, and as supplied to railways all over the world. A four-way street traffic signal—as shown in Fig. 32—is another exhibit. These signals are operated in various ways, but the particular signal shown is manually controlled, and is suitable for use where the traffic is very complex. The operator is housed in a tower, or takes up some other position where he is out of danger and can see the whole of the traffic that has to be controlled. Other methods of control that may be adopted are (*a*) local or independent, (*b*) synchronised, (*c*) staggered, and (*d*) progressive. Local or independent control is similar to manual control, and applies to isolated intersections which are not controlled with any relation to other crossings, and an automatic controller worked from the local lighting supply is employed instead of a manually operated switch. Synchronised control is the simplest form of control that can be used where a series of right-angle streets lead off a main street. In this case the signals at the various intersections are synchronised; in other words, all signals show the same colour in the same direction simultaneously, and the signals are synchronised by automatic controllers at each intersection or can be worked from one controller by means of interconnecting cables. Staggered control is similar to synchronous control in that all signal indications change simultaneously, but the various indications are "staggered," *i.e.*, alternately "Stop" and "Go." It is only suitable where blocks are of equal length, and under these conditions it allows the traffic to proceed at a predetermined speed, the operation being effected in the same way as with synchronous control. Progressive control is the most

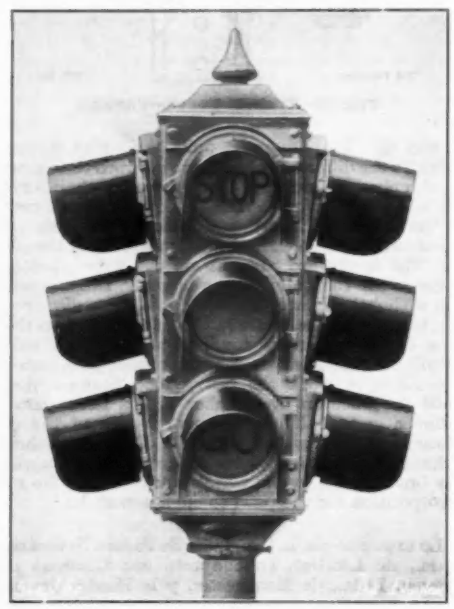


FIG. 32—TRAFFIC SIGNAL—G.E.C.

flexible of the automatic system, and is particularly suitable for thoroughfares where the blocks are of unequal length, the timing of the signals being such as to allow traffic running at a certain speed to proceed without stops. The signals at each intersection are controlled by local controllers, which are actuated in turn by a master controller. The wiring of the signals at the intersection is local, but two control wires are required between the master controller and the separate local controllers. With this system waits, if any, are very short, pedestrian traffic is facilitated, and the average speed of vehicles is kept within safe limits.

Four main types of signals are available, viz., a single signal bracketed on the side of a pole, a single signal for mounting on the top of a pole, a four-way signal for suspension mounting, and a four-way signal for pedestal mounting. These signals will be found to meet practically all requirements, but the makers are prepared to design signals of special shapes to meet any peculiar requirements. The optical system of the signals has been designed with a view to producing maximum intensity of illumination, together with a wide angle of diffusion, while the setting of the lenses has been contrived to minimise the effect of the sun's rays or any other extraneous

source of light. A specially designed reflector is employed, which enables standard commercial gas-filled lamps to be used, and the outer coloured screen is composed of a special glass designed to break up the light and to give an even illumination over a wide angle of vision. The diameter of the opening is 8in., and each lens is fitted with a sloping hood which serves to shade it from the direct rays of the sun.

The body of the signal consists of a lightweight casting having three openings for the lenses. The reflectors and lampholders are mounted in the body of the signal, and the lampholders are wired to a series of terminals to which the outside wires are connected.

The lenses and hoods are fitted on cast hinged doors which are provided with gaskets to exclude dust and rain. To renew lamps it is simply necessary to unscrew one thumb-screw in each door. Signals can be mounted on the top of posts or be bracketed from the post. In the latter case the signal may be in front or to one side of the post. Four-way signals may be suspended from a catenary wire, or, alternatively, they can be mounted on a pedestal. Signals mounted on posts are provided with facilities for alignment in any direction.

La Compañía General Eléctrica de Witton en Birmingham, expone productos de ingeniería industrial y utensilios para alumbrado y economía domésticas. Motores normales de corriente contínua o alternada con reguladores de marcha, un interruptor de gran velocidad de 200 amperios para contínua, un cortacircuito de contacto de línea para 200 amperios, un motor para tracción y control como el suministrado a la compañía Buenos Aires Central Terminal Railway, y una colección de transformadores, constituyen el muestrario de ingeniería industrial; en tanto que las plantas mayores hechas por la compañía van expuestas en fotografías. A mas de aparatos para alumbrado y economía casera de varias clases, la compañía expone aparatos de radiotelefonía y para señales ferrocarrileras, fabricadas por la Compañía Siemens and General Railway Signalling, tal como se entregan a los ferrocarriles de todo el mundo. Una señal para tráfico de 4 vías-como lo muestra la Fig. 32—es otro de los artículos expuestos. Estas señales trabajan de varias maneras, pero la que se ve es dirigida a mano, y es conveniente endonde el tráfico es muy complicado. El operador secoloca en una torre o se pone en una situación donde no corra peligro y pueda ver el tráfico todo que tiene que dirijir. Otros métodos de control que se puede adoptar son (*a*) el local o independiente, (*b*) sincronizado, (*c*) intermitente, (*d*) progresivo. El control local o independiente es semejante al control a mano, y se aplica a secciones aisladas que no están controladas con relación a otros cruces, y un control automático se usa que opera con la corriente del alumbrado en lugar del operado con la mano. El control sincronizado es el mas simple que puede usarse donde una série de calles en ángulo recto salen de una avenida principal. En este caso las señales en las varias intersecciones están sincronizadas; en otras palabras, todas las luces tienen el mismo color en determinado momento y en la misma dirección simultáneamente, y las señales van sincronizadas por controles automáticos en cada intersección o pueden ser mandadas desde una garita de control por cables combinados interconectados. El control intermitente escalonado es similar al sincronizado en cuanto las señales cambian simultáneamente, pero las varias señales van escalonadas, es decir, "pare" y "siga" alternadamente. Solo es conveniente donde las cuadras son de un largo uniforme, y en esas condiciones permite al tráfico adelantar a una velocidad prearreglada, siendo la operación la misma que la del sistema sincronizado. El sistema progresivo es el mas flexible de los sistemas automáticos, y es particularmente adaptable en calles con bloques de largo desigual, siendo el tiempo regulador de las señales tal que permite al tráfico moverse a cierta velocidad sin paradas. Las señales en cada intersección están gobernadas por los controles locales los que a su vez van mandados por un control principal. Las conexiones para las señales en la intersección son locales, pero hay dos cables de control que unen el control maestro y los locales. Con este sistema las esperas, si las hay, son muy cortas, el tráfico peatón se facilita, y la velocidad media de los vehículos se mantiene dentro de límites seguros. Se puede obtener 4 tipos de señales, a saber, una señal sencilla puesta en una ménsula en un poste, al costado de este, una señal sencilla en la punta de un poste, una señal de suspensión de 4 vías, y una señal de 4 vías para colocar sobre un pedestal. Estas señales llenan prácticamente todos los requisitos, pero los fabricantes están dispuestos a proyectar señales de formas especiales para llenar requisitos especiales. El sistema óptico de señales ha sido calculado para que de el máximo de intensidad luminosa junto con un ángulo amplio de difusión, en tanto que la posición de las lentes es la mejor para evitar el efecto de los rayos solares o de cualquier otra fuente de luz. Un reflector dibujado especialmente se emplea, el que permite usar las lámparas comunes comerciales de ázoe, y la pantalla externa coloreada se compone de cristal especial hecho para difundir la luz y dar una iluminación pareja en un ángulo amplio de visión. El diámetro de la abertura es de 8″ [203 mm.] y cada lente va provista de una visera inclinada que sirve para protegerla de los rayos directos del sol. El cuerpo de la señal consiste en una pieza de fundición liviana con tres abertures para las lentes. Los reflectores o portalámparas están montados en el cuerpo de la señal, y los portalámparas están conectados por hilos a una série de terminales a los cuales se conecta las líneas de la calle.

Las lentes y viseras están fijas en puertas fundidas con bisagras y provistas de pestañas para protegerlas del polvo y de la lluvia. Para renovar las lámparas solo se necesita desatornillar un tornillo de oreja en cada puerta. Las señales se pueden colocar en el tope de los postes o en una ménsula al costado del mismo. En este caso la señal puede estar al frente o al lado del poste. Las señales de 4 vías pueden colgar de un cable en catenaria, o como una alternativa montados en un pedestal. Las señales colocadas en postes tienen facilidades para orientarlas en cualquier dirección deseada.

The Parsons Oil Engine Company, Ltd.

Three representative examples of the extended series of marine types of oil and petrol engines which is manufactured by the Parsons Oil Engine Company, Ltd., of Southampton, are displayed on the stand of the company's agents, Messrs. A. G. Pruden and Co. In Fig. 33 we illustrate one of the engines shown, which is a four-cylinder model with a cylinder bore of 2¾in. and a stroke of 4in., having a designed output of 10 to 20 B.H.P. at speeds of 1000 to 2000 r.p.m. The crank case is of the monobloc type and is attached to a robust bed-plate, the object of the design being to maintain full rigidity and strength with a reasonable weight. The crank shaft is supported in three bearings and is bedded into the lower part of the crank case, bearing caps being provided. A feature of this crank case design is the provision of large-sized inspection doors, which give ready access to the working parts. It may be noted that the lower part of the crank case is extended to join the casing for the reverse gear, thereby forming a stiff and rigid one-piece casting. The engine is equipped with magneto ignition and electric starting, and the lubricating oil and water circulating pumps are of the plunger type and are engine driven. The reverse gear comprises a plate clutch for the ahead drive, with bevel gears and a band brake giving full engine speed astern. The whole of the gear, including the fly-wheel, is enclosed, and the working parts, including the ball type thrust bearing, are lubricated by the engine system. The starting controls are neatly grouped at the fly-wheel end of the engine, and access to the sparking plugs is gained by removing a light cover on the cylinder tops. Another engine which is shown is a four-cylinder 25 to 45 B.H.P. unit, at a speed range of 1000 to 2000 r.p.m. The cylinders are 3¾in. bore with a 5in. stroke, and the design embodies some new constructional details. The crank shaft is carried on five capped bearings, and a double-acting plunger type circulating pump is mounted at the forward end of the engine, the lubricating oil pump being housed within the crank case. The largest engine in this series is a six-cylinder, with an output of 35 to 65 B.H.P. at similar speeds. The third engine shown is one of a series with 4¾in. diameter cylinders and 6in. stroke, embracing four, six, and eight cylinders, with outputs up to 160 B.H.P. It is a 75 to 120 B.H.P. six-cylinder unit designed to run at speeds from 1000 to 1800 r.p.m. The cylinders are cast in pairs and are separate from the crank case. The lower part of the crank case carries the crank shaft, which is supported in seven capped bearings. In this engine the induction system is arranged for two groups of three cylinders. The general arrangement of the auxiliary pumps, the reverse gear, and the controls follows that of the engine we illustrate in Fig. 33, but the construction and scantlings are heavier and are in excess of Lloyd's requirements. The engines we have referred to can also be supplied as auxiliary lighting units or for industrial driving.

Tres ejemplos representativos de la extensa série de tipos marinos para motores de aceite crudo y nafta que fabrica la Compañía de Motores a Petróleo Parsons, Ltda., de Southampton, se ven en el stand de los Sres. A. G. Pruden y Cía. En la Fig. 33 mostramos una de las máquinas expuestas la que es un modelo de 4 cilindros con un alma de cilindro de 2¾″ y una carrera de 4″ [70 × 101 mm.], con un rinde calculado de 10 H.P. a 20 H.P. a velocida des de 1000 a 2000 revoluciones por minuto. El carter es del tipo monobloque y está asegurado a una base robusta, siendo el objeto del modelo mantener rigidez completa y fuerza con peso razonable. El cigüeñal va soportado por 3 cojinetes embutidos en la parte baja del carter, con tapas para los cojinetes. Un rasgo de este diseño de carter es la provisión de puertas de inspección de tamaño amplio, que permiten acceso fácil a las partes movibles. Se notará que la parte baja del carter se extiende hasta juntarse con el carter de los engranages de retroceso, formando así una pieza fundida rígida y sólida. El motor tiene un magneto para ignición y arranque eléctrico, y las bombas para las circulaciones de agua y de aceite son del tipo de émbolo y van mandadas por el motor. La contramarcha comprende un embrague de disco para adelante, y engranages cónicos y un freno de banda que admite toda velocidad hacia atrás. El conjunto de los mecanismos incluido el volante, está encerrado protegido, y las partes móviles, incluidas el centro de empuje de bolas, están enaceitadas por el sistema del motor. Los controles de arranque están netamente agrupados en el lado del volante del motor, y el acceso a las bujías se obtiene sacando una tapa liviana que cubre las culates de los cilindros. Otro motor que se expone allí, es un 4 cilindros de 25 a 45 H.P., a velocidades de 1000 a 2000 revoluciones por minuto. Los cilindros tienen un ánima de 3¾″ y una carrera de 5″ [95 × 127 mm.], y el diseño incorpora algunos detalles nuevos de construcción. El cigüeñal va soportado por 5 cojinetes especiales, y en el extremo delantero del motor va fijada una bomba de circulación de doble acción a émbolos; la bomba de aceite va alojada dentro del carter. El mayor motor de esta serie es un seis cilindros, que rinde de 35 a 65 H.P. a velocidades semejantes. El tercer motor expuesto es uno de una serie concilindros de 4¾″ de ánima y 6″ de carrera [120 × 152 mm.], comprendiendo motores de 4, 6, y 8 cilindros con rindes hasta de 160 H.P. Es una unidad de 6 cilindros de 75 a 120 H.P. proyectada para trabajar entre 1000 y 1800 revoluciones por minuto. Los cilindros van fundidos en pares y van separados del carter. La parte baja del carter lleva el cigüeñal que está soportado por 7 cojinetes especiales. En este motor el sistema de entrada ya arreglado en 2 grupos de 3 cilindros. El arreglo general de las bombas auxiliares, el mecanismo de la contramarcha, y los controles se parece al del motor que mostramos en la Fig. 33, pero la construcción y refuerzos son mas sólidos y exceden las exigencias del Lloyd. Los motores a que nos hemos referido pueden también suministrarse como unidades auxiliares para alumbrado o para fuerza motriz en talleres.

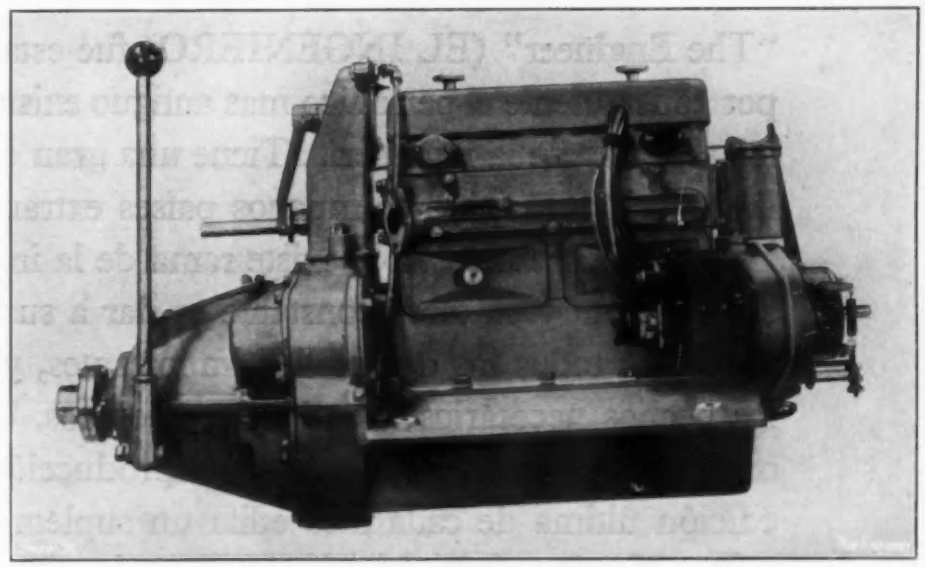


FIG. 33—10-20 B.H.P. PETROL ENGINE—PARSONS

"THE ENGINEER"

"The Engineer" (EL INGENIERO) fué establecido en 1856, y es por consiguiente el periódico mas antiguo existente dedicado a todos los aspectos de la ingeniería. Tiene una gran circulación no solo en la Gran Bretaña sino en muchos países extranjeros así como en los Dominios Británicos. No existe rama de la ingeniería que escape a su atención, y su tarea constante es dar a sus lectores una versión exacta de todos los desarrollos importantes, y suministrarles todos los hechos necesarios, científicos y técnicos. Un rasgo del que está orgulloso, y con derecho, es la reproducción de dibujos. En la edición última de cada mes edita un suplemento gratuito llamado "The Metallurgist" (El Metalúrgico) en el que se pasa revista al progreso de la ciencia y tecnología metalúrgica.

Recomendamos a Vd. el que vea ejemplares de "The Engineer" para marzo 13 y siguientes ediciones por mas detalles de la Exposición de Buenos Aires, y los renglones de ingeniería expuestos allí. Pueden obtenerse en la Exposición Pabellón No. 9, Stand No. 840 o pidiéndolos a:

The Manager,
"The Engineer,"
28, Essex Street,
Strand, W.C.2,
Londres.

HERBERT

SURPLUS RAILWAY PLANT.

TANGYE 12″ x 14′ 0″ DOUBLE ENDED AXLE TURNING LATHE, centre driven, two saddles, motor drive.

New and Unused - - - £450

Inspection at Coventry.

ALFRED HERBERT LTD. COVENTRY

CAROBRONZE CONDENSER TUBES

COLD DRAWN FROM A BILLET ABSOLUTELY FREE FROM ZINC AND IRON.

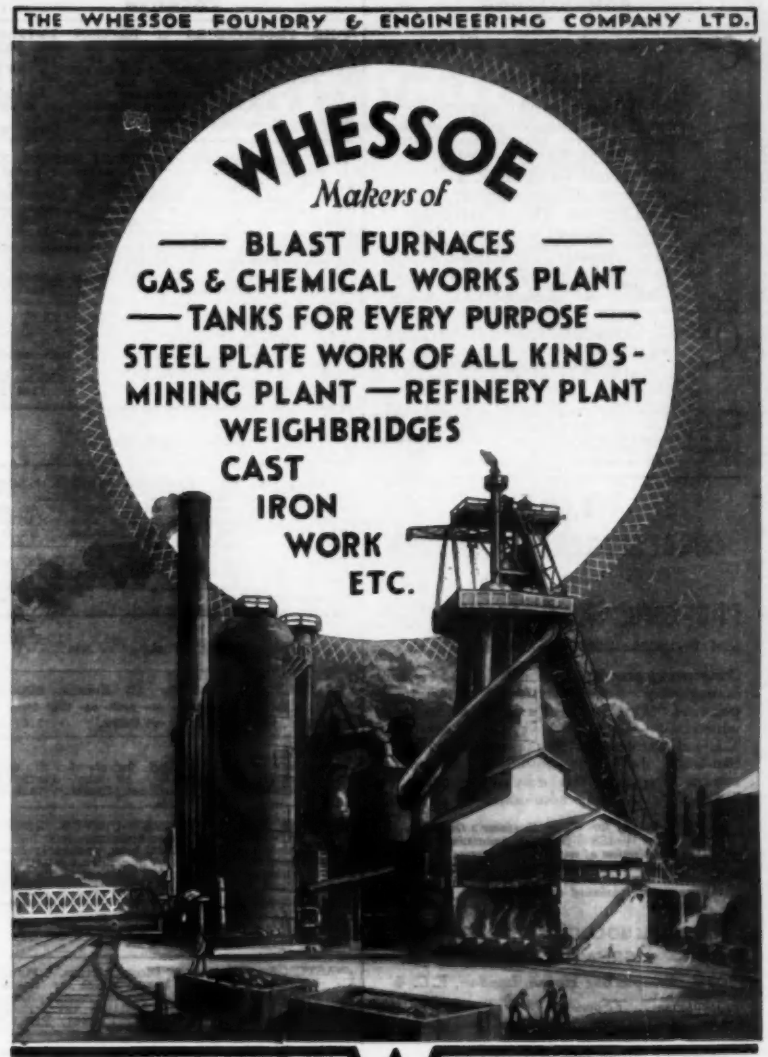
RESIST CORROSION, EROSION, FATIGUE.

SUBMIT YOUR CONDENSER WORRIES TO US AND YOU — WILL REDUCE INITIAL AND REPAIR COSTS. —

CAROBRONZE LIMITED,
85-86, New Bond Street,
LONDON, W. 1.

TELEPHONE:
MAYFAIR 1048/9.

THE WHESSOE FOUNDRY & ENGINEERING COMPANY LTD.



Head Office & Works DARLINGTON-ENGLAND — WHESSOE — London Offices 25 VICTORIA ST-S.W.1

BRABY

STEEL PLATE WORK

CYLINDERS, AIR DUCTS, STEEL CHIMNEYS, ICE PLANT UNDERGROUND STORAGE, WATER TOWERS, HOPPERS, GEAR CASES, VAN BODIES, CYCLONES, ETC.

FREDK. BRABY & CO., LTD.,
352-364, Euston Road, LONDON, N.W. 1,
AND AT
Deptford, Liverpool, Bristol, Plymouth, Glasgow, Falkirk, Motherwell, Belfast and Dublin.

EDUCATIONAL

Correspondence Courses
OF
PREPARATION
FOR THE
Examinations
OF THE
INST. OF CIVIL ENGINEERS.
INST. OF MECHANICAL ENGRS.
INST. OF STRUCTURAL ENGRS.
UNIVERSITY OF LONDON, &c.
ARE PERSONALLY CONDUCTED BY
Mr. Trevor W. Phillips,
B.Sc., Honours, Engineering, London University, Assoc. M. Inst. C.E., A.M.I. Struct. E., M.R.S.I., F.R.S.A., Chartered Civil Engineer, &c.
For full particulars and advice apply to :—
36, DALE STREET, LIVERPOOL.
LONDON OFFICE :—65, CHANCERY LANE, W.C. 2.

Oxford Correspondence College,
BEAUMONT HOUSE, OXFORD.
THOROUGH POSTAL PREPARATION FOR :—
B.Sc. (ENGINEERING), Pass and Honours.
A.M.I.C.E.,
A.M.I.M.E.,
and also Electrical, Structural, Aeronautical, Automobile and Marine Engineering Examinations.
Low fees—payable monthly. 50 Tutors, Individual Attention. Textbooks loaned.
Prospectus from the Secretary.

T.I.G.B.
CORRESPONDENCE COURSES
FOR THE
PROFESSIONAL EXAMINATIONS
A.M. Inst. C.E., A.M.I. Mech. E., A.M.I.E.E., etc.

Convincing proof that The T.I.G.B. training is markedly successful is found in the many pages of "The Engineer's Guide to Success" which are filled with typical results of T.I.G.B. Students. This testimony of former Students obviously provides the soundest reason why you too may enrol with The T.I.G.B. with every confidence in the issue

Write to-day for "The Engineer's Guide to Success" — 128 pages — containing the widest selection of engineering courses in the world, and mention the branch, post or qualification that interests you. The T.I.G.B. guarantees training until successful for the one fee.

THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN,
76, Temple Bar House, London, E.C. 4
(Founded 1917.)

MISCELLANEOUS

ENGINEERS —

We offer you the finest and most complete book on Engineering Careers ever compiled — absolutely FREE of charge. This book contains 180 pages of invaluable information and advice. It also contains details of B.Sc., A.M.I.C.E., A.M.I. Mech. E., A.M.I.E.E., A.M.I.A.E., A.M.I. Struct. E., M.R. San. I., L.I.O.B., F.S.I., G.P.O., C. and G., etc., Exams., outlines home-study Courses in all branches of Civil, Mechanical, Electrical, Motor, Wireless, Aeronautical and "Talkie" Engineering and explains the unique advantages of our special Appointments Department. WE ALONE GUARANTEE "NO PASS—NO FEE." You owe it to yourself to read our Handbook. Send to-day, stating branch or subject of most interest.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY.
22, Shakespeare House, 29-31, Oxford St., W.1.
P1145 I

PATENTS

BRITISH PATENTS 202,319, 219,708, 154,609, 277,657, 214,647, 221,826, 315,422, and 338,096, relating to "Hubs for Cycles," are FOR SALE or LICENCE.—Apply to S. SOKAL, Chartered Patent Agent, 1, Gt. James-street, London, W.C. 1. 7068 H

KINGS PATENT AGENCY, Ltd. (B. T. KING. Regd. Patent Agent, G.B., U.S., and Can.). "Advice handbook" and consultations on Patents and Trade Marks FREE.—146a, Queen Victoria-street, London, E.C. 4. 45 years' ref. 'Phone : Central 0682. 6755 H

PATENTS AND DESIGNS ACTS, 1907 TO 1928.—It is hereby notified that the OWNERS of BRITISH PATENT No. 233,580, for "Improvements in or relating to Carburettors for Internal Combustion Engines," are PREPARED to ENTER into NEGOTIATIONS with interested parties for the SALE of the PATENT and other BRITISH PATENTS relating to Carburettors, &c.—Communications please address to Messrs. DICKER, POLLAK and MERCER, Chartered Patent Agents, 20-23, Holborn, London, E.C. 1. 7130 H

THE PROPRIETOR of BRITISH PATENT No. 219,274, dated July 19, 1923, relating to "Tool for Cutting and Removing Pipe from Wells," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 7107 H

THE PROPRIETORS of BRITISH PATENT No. 231,179, relating to improved electrolytic manufacture of iron, are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to WORK thereunder.—Address, BOULT, WADE and TENNANT, 112, Hatton-garden, London, E.C. 1. 7133 H

PATENTS : "Improvements in Frames or Carriages for Light Guns, Bomb Projectors, or the like."
THE PROPRIETORS of Mr. G. Madaschi's BRITISH PATENT No. 290,850 are DESIROUS of LICENSING the PATENT to British Manufacturers on reasonable terms to ensure its USE and DEVELOPMENT in Great Britain, or of SELLING the PATENT outright.
For full information address inquiries to W. P. THOMPSON and CO., Chartered Patent and Trade Mark Agents, 12, Church-street, Liverpool. P1244 H

THE PROPRIETORS of BRITISH PATENTS Nos. 261,319 and 266,229, relating to "Railway Car Axles," are DESIROUS of ENTERING into ARRANGEMENTS with British Manufacturers with a view to the SALE or Commercial EXPLOITATION of the inventions protected by the said Patents.
Interested parties are invited to communicate with the undersigned for further particulars :
H. N. and W. S. SKERRETT,
Patent Agents,
P1238 H 24, Temple-row, Birmingham.

PATENTS

THE PROPRIETORS of BRITISH LETTERS PATENT No. 284,040, dated 26th July, 1926, for : "Production of Iron from Iron Ores," are DESIROUS of DISPOSING of the PATENT RIGHTS or of NEGOTIATING for the GRANTING of LICENCES to work thereunder. — All inquiries should be addressed to Messrs. MEWBURN, ELLIS, and CO., 70-72, Chancery-lane, London, W.C. 2. P1242 H

THE PROPRIETORS of BRITISH PATENT No. 229,561, relating to "A Punching or Pressing Machine for Punching Roll Pockets in the Cages of Roller Bearings," are DESIROUS of ENTERING into ARRANGEMENTS with British Manufacturers with a view to the SALE or Commercial EXPLOITATION of the invention protected by the said Patent.
Interested parties are invited to communicate with the undersigned for further particulars :
H. N. and W. S. SKERRETT, Patent Agents, 24, Temple-row, Birmingham. P1237 H

THE PROPRIETORS of BRITISH PATENT No. 238,237 are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work thereunder. It relates to a method and improvements in machines for cutting the teeth of wheels, racks, or the like.—Address : BOULT, WADE and TENNANT, 112, Hatton-garden, London, E.C. 1. 7144 H

WORK WANTED

WANTED to MANUFACTURE SPECIAL MACHINERY or ENGINEERS' APPLIANCES. Up-to-date machine plant for either heavy or medium work. Own foundry and pattern shop.—EASTON and JOHNSON, Ltd., Engineers, Taunton. Ex. M

THE GOOLE SHIPBUILDING CO., Goole, will QUOTE IRONWORK, COPPERSMITH, PLUMBING WORK on receipt specifications.—Address, P1250, The Engineer Office. P1250 M

MACHINERY, &c., WANTED

WANTED to HIRE for 2/3 Months, SCOTCH CRANE, 120ft. jib, to pick up 2/3 tons.
Address, 7147, The Engineer Office. 7147 F

WANTED.—TWO IRON GIRDERS, for about 90ft. span, capable carrying moving load 30 tons.—Particulars to CLARIDGE, Timber Merchant, Exeter. 7125 F

BORING BAR and SCREW-DRIVEN BORING HEAD WANTED. Bar approximately 18in. to 20in. diameter, minimum 24ft. long, preferably driven by worm and wheel. Must be in excellent condition.—Full particulars and offers to Box 484, Sells Advertising Offices, Fleet-street, E.C. 4. 7131 F

FOR SALE

CASTINGS, Forgings, Discs, Rings, Flanges, Blanks, Component Parts, rough or finished, Machined (in Ferrous and Non-ferrous Metals). Keenest prices.—ELLACOTT ENGINEERING CO., Robert-street, Sheffield. 'Phone and 'grams, 43361. P1151 O

ENGINES.—DIESEL.—KRUPP FOUR-CYLINDER 65 H.P. BLAST ENGINE FOR SALE, £250. Formerly fitted in ex-Kaiser's yacht "Meteor," just completely overhauled and in excellent condition. Can be inspected any time.—Apply, VOSPER and CO., Portsmouth. 7159 O

FOR SALE

600
FOR DISPOSAL
20-TON OVERHEAD ELECTRIC TRAVELLING GANTRY CRANE
by **STOTHERT and PITT.**

Span 30ft. 2in. Short traverse 25ft. 6in. Gauge of lifting carriage 4ft. 6in. Drum 17in. dia. by 32in. wide. Complete with all controls. Long traverse Motor 8 H.P., short traverse 6 H.P. Hoisting Motor 12 H.P., all 220 volts D.C., by Siemens.
EXCELLENT CONDITION.
INSPECTION INVITED.
Send for full details and prices to :—
GEO. COHEN, SONS AND CO.,
LIMITED.
Gas Works Road, NEATH.
Tel.: 476 Neath.

FOR SALE by TENDER, High-class POWER PLANT. Owing to reorganisation of our works the following very high-class Steam Generating Plant is for Sale by Tender :—
ONE Belliss and Morcom High-speed Triple-expansion Engine, direct coupled to Dick-Kerr Direct current Generator, 500 kW, 330 r.p.m., 220 to 240 volts, compound wound.
One Combe-Barbour High-speed Triple-expansion Engine, direct coupled to British Westinghouse Direct-current Generator, 220 to 240 volts, 400 kW.
Three Lancashire Boilers, each 30ft. by 8ft. diameter, insured for working pressure of 200 lb. per square inch, each fitted with Ferguson's Patent Superheaters and Turbine Furnaces, Hopkinson's Mountings.
One W. H. Allen and Son High-speed Compound Engine, direct coupled to One B.T.H. Direct-current Generator, 150 kW, 220 to 240 volts.
All necessary Auxiliary Plant, comprising Edwards Dry Air Pump and Condenser, Centrifugal Pump, Boiler Feed Pump, and All-steel Steam Piping.
Offers for the complete equipment or portions of same will be received up to 18th July. The plant can be seen in operation at any time at FALLS FOUNDRY, Belfast, and offers should be addressed there to FAIRBAIRN LAWSON COMBE BARBOUR, LTD. 7108

FOR SALE, No. 6 Ruston NAVVY on Caterpillars, in good condition ; just finished job ; £900 or offer.
FOR SALE, TWO 24in. gauge Hudson 0-4-0 STEAM LOCOMOTIVES in good condition ; £190 each or offers.
Address, 7084, The Engineer Office. 7084 O

FOR SALE, THEODOLITES.
DRAWING INSTRUMENTS, SECOND-HAND.
CLARKSON'S, 338, High Holborn, W.C.
(Opposite Gray's Inn-road).
FOR SALE, LEVELS.
DRAWING INSTRUMENTS, SECOND-HAND.
CLARKSON'S, 338, High Holborn, W.C.
(Opposite Gray's Inn-road). Ex.

FOR SALE

FOR IMMEDIATE DISPOSAL.
ONE 8ft. by 8ft. by 24ft. PLANING MACHINE, electric drive.
ONE 6ft. by 6ft. by 22ft. PLANING MACHINE, electric drive.
ONE HORL. and VERTL. PLANING MACHINE, 12ft. by 8ft., electric drive.
ONE 5ft. BORING and TURNING MILL.
Also LATHES and CYLINDRICAL GRINDING MACHINES.
HULSE and CO., Ltd., Ordsal Works, Salford. 7154 O

HYDRAULIC FLANGING PRESS, 150 Tons, by Fielding and Platt, Ltd., with two 18in. dia. vertical rams by 24in. stroke, one horizontal ram 7in. dia. by 14in. stroke, one lifting ram 7in. dia. by 24in. stroke, distance from centre of ram to frame 5ft. 3in. and 3ft. 3in., heavy slotted bed 7ft. 3in. by 4in. with extended bed, 700-800 lb. per sq. in.
PRICE £400 f.o.r.
HYDRAULIC FLANGING PRESS, as above, except two vertical rams 10½in. dia. by 30in. stroke, one horizontal ram 3½in. dia. by 24in. stroke, bed 6ft. 3in. by 3ft. 6in., extended table, &c.
PRICE £300 f.o.r.
Photographs and full particulars from :—
JOHN CASHMORE, GREAT BRIDGE, STAFFS.

NEARLY NEW 5-Ton ELECTRIC DERRICK CRANE, all steel, lattice jib 75ft., 3-phase, 400-volt, 50 cycles.—J. T. WILLIAMS and SONS, 37, Queen Victoria-street, London. 7156 O

For continuation of For Sale Advertisements see page 62.

Spencer-Bonecourt Patent Waste Heat Boilers.
Broadway Bldgs., Broadway, Westminster, S.W. 1.

STONEBREAKERS
Crushing Rolls,
Screens, Elevators and Conveyors
Complete Plants for fine crushing or Macadam are our Speciality.
ROBERT BROADBENT & SONS, Ltd.,
Phœnix Ironworks, STALYBRIDGE.
Telephone No. 256. Tel. Address—Broadbent Stalybridge

Clarkes of Lincoln only make Crankshafts & Forgings but they can make them!
CLARKE'S CRANK & FORGE CO. LTD — LINCOLN
Associated with R.G.E. Ltd.

GARNER, TELFORD & HARDMAN
LIMITED
RIVETTED or WELDED WORK
of all descriptions
PENDLETON, MANCHESTER

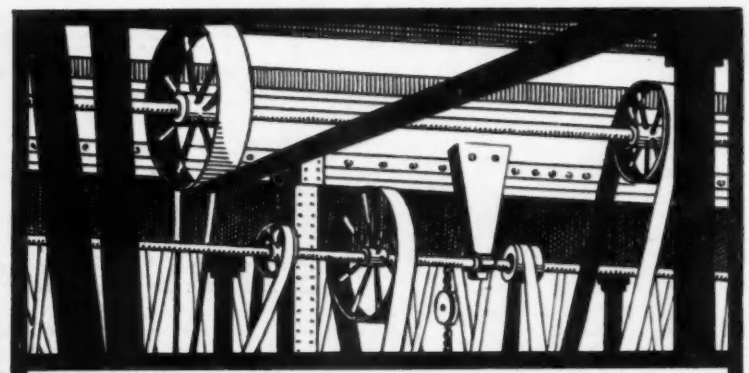
HAGAN
STEAM SEPARATORS
ENSURE CLEAN DRY STEAM.
JAMES GORDON & CO., LTD.,
Windsor House, Kingsway, LONDON.
'Phone : Holborn 3232.

Polar
REFRIGERATING MACHINERY
INSULATION OF COLD SPACES
THE LIVERPOOL REFRIGERATION Co. Ltd.
LIVERPOOL
L.R. Co.

Superior Castings
Wallwork
HENRY WALLWORK & CO., Ltd., MANCHESTER.

PETTER
OIL & PETROL ENGINES
SIZES 1½ TO 400 B.H.P.
PETTERS LIMITED
LONDON 75b, QUEEN VICTORIA ST. E.C.4
Works YEOVIL, ENGLAND

TANKS
GALVANISING & CONSTRUCTIONAL IRONWORK.
JOSEPH ASH AND SON, LIMITED,
Rea-street South, BIRMINGHAM.



THE WHEELS OF INDUSTRY
run more efficiently and more economically WHEN
TEON
belting is used. It is the strongest, most durable and lasting belt known.
Write the Sole Manufacturers :
FLEMING, BIRKBY & GOODALL, LTD.,
WEST GROVE MILL, HALIFAX, ENG.
Telephone : 3748 (2 lines).
Telegrams : "Fleming, Phone, Halifax."
London : 1, Broad Street Place, E.C. 2.

LIGHT AND HEAVY STEEL PILING
from 25 to 49·5 lbs. per square foot. Sections to suit every class of work. Economical, Strong, Watertight.
BRITISH MANUFACTURE
The Side Groove Steel Piling Supply Co., Ld.
17, Victoria Street, S.W. 1. Tel. Vic. 1325.

Are your Machine Tools handicapped?

Many enterprising engineers have realised that they cannot expect a high output from machine tools which are driven by antiquated methods. Modern methods call for electrically-driven machine tools, embodying efficient automatic push button control.

IGRANIC
Automatic Push Button CONTROL

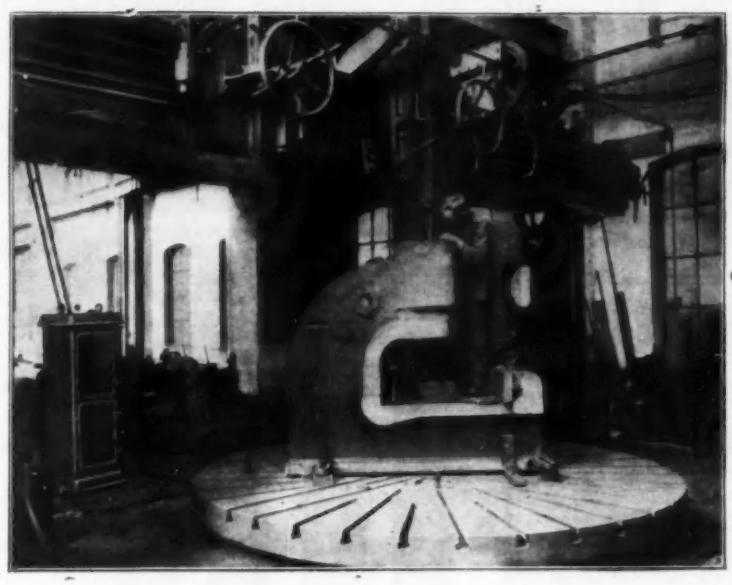
governs every operation of electrically-driven machine tools by the simple pressure of buttons. No special knowledge is required for operation. Automatically confines the speed and load within safe limits. **Functions automatically and always correctly.**

Write to Dept. V. 154.

CONTROL IGRANIC ELECTRIC Co. Ltd. DEVICES

149, Queen Victoria St.

Works: BEDFORD.



Large electrically-driven Boring Mill, automatically controlled by Igranic Push Button Control Gear.

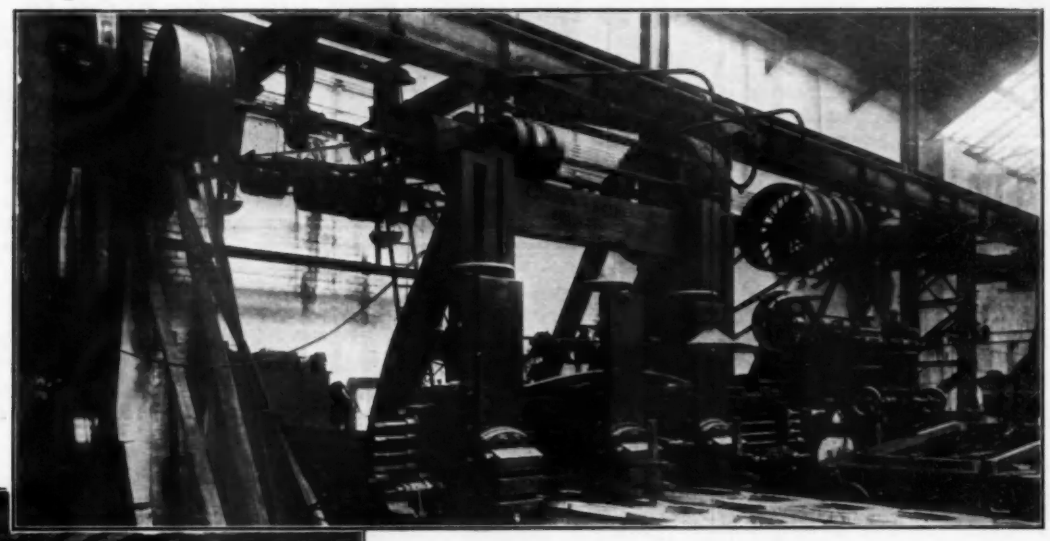
Branches: BIRMINGHAM, BRISTOL, GLASGOW, LEEDS, MANCHESTER, NEWCASTLE.

NORTHUMBRIA *leather belting*

Transmits . . the Full . . . Power

(a) Heavy duty work: driving a heavy planing machine.

(b) Uniform rigging of a Flax Mill in Calcutta using 40,000 feet of Northumbria Leather Belting.



Northumbria Leather Belting is rendering efficient service all over the world in a multitude of different industries. Plant Engineers appreciate its dependability and experience a maximum transmission of the power output and a minimum loss of idle time in stoppages. Its long life and efficiency are the consequence of the quality of Raw Materials and high grade workmanship. Only the finest Ox Strap Butts are used in its manufacture. It is cured with Newfoundland Cod oil and stretched in its wet state.

All sizes are in stock from ½″ to 40″ and we invite enquiries from Plant Engineers for our recommendations as to the most suitable grades for their power transmission needs.

GEORGE ANGUS & CO. LTD.

Telamite Works, Bentham, Lancaster.
St. John's Works, Newcastle-on-Tyne.
Export Dept. 7, Bury Street, St. Mary Axe, London, E.C. 3. I. 29

NEW "Thompson"

BOILERS

EX STOCK.

MOST MODERN "DISH-END" TYPE

WITH CORRUGATED SECTIONS.

	Shop No.
1–30ft. × 9ft. 3in. × 200lbs. W.P.	6948
1–30ft. × 9ft. 3in. × 120lbs. W.P.	7012
1–30ft. × 9ft. 3in. × 120lbs. W.P.	7060
2–30ft. × 8ft. 6in. × 160lbs. W.P.	6970/1
2–30ft. × 8ft. 6in. × 120lbs. W.P.	6983/4
1–30ft. × 8ft. 3in. × 160lbs. W.P.	7054
1–30ft. × 7ft. 6in. × 120lbs. W.P.	6945
2–24ft. × 6ft. 6in. × 150lbs. W.P.	6974/5
1–10ft. × 4ft. 0in. × 120lbs. W.P.	6443
1–30ft. × 8ft. × 180lbs. W.P.	6574 (F.E.)

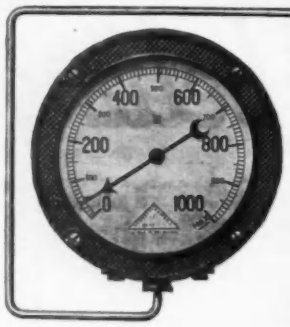
All the above Boilers are built from "Siemens Martin" Acid Steel.

Also WATER-TUBE, ECONOMIC, CORNISH & VERTICAL BOILERS

SUPERHEATER AND PIPEWORK INSTALLATIONS.

Repairs to all types of Boilers by first-class men.

JOHN THOMPSON (WOLVERHAMPTON) LTD., WOLVERHAMPTON, ENG.



DISTANCE THERMOMETER

MERCURY-IN-STEEL TYPE WITH COMPENSATED CAPILLARY TUBING.

UNRIVALLED FOR ACCURACY AND LONG SERVICE UNDER SEVERE CONDITIONS.

WRIE FOR LIST E5.

NEGRETTI & ZAMBRA

38, HOLBORN VIADUCT, LONDON.

FOR LAND & MARINE PLANTS

PUMPS

DAWSON & DOWNIE LTD. CLYDEBANK.

See illustrated advt.

Good Tracing Cloth makes all the difference.

BRITISH (R.C.) **MADE**

TRACING CLOTHS

MANSFIELD, WINCHESTER, STIRLING AND CLYDE.

For transparency combined with durability the R.C. brands have never been surpassed. Being made of the finest long staple Egyptian cotton, carefully carded and combed, they are exceptionally free from weaving and finishing faults. During their manufacture they are subjected to a special treatment in order to reduce—and, in practice, almost eliminate—the liability to distortion caused by changes of humidity and temperature. A special finish, applied to no other brand of cloth, enables them to be drawn upon with great ease. In addition to these precautions, before being marketed the cloth is examined for faults, and any material which falls below a high standard is cut out, so that the trade mark R.C. may truly be considered the standard of excellence.

B. J. HALL & Co. LTD.

(SOLE DISTRIBUTING AGENTS)

STOURTON HOUSE, DACRE ST., WESTMINSTER, S.W.1.

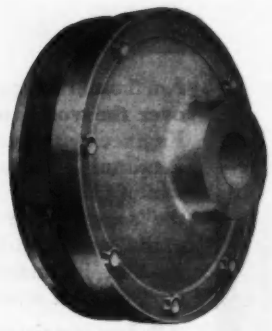
3, BOND COURT, WALBROOK, E.C.4.

SHELL CORNER, KINGSWAY, W.C.2.

Also at BIRMINGHAM, MANCHESTER, NEWCASTE-ON-TYNE and GLASGOW.

STEEL-SHAW

STEELE & COWLISHAW ENGINEERS STOKE-ON-TRENT



"Z.V." Flexible Coupling

FLEXIBLE COUPLINGS

The Steel-Shaw Z.V. Flexible Coupling protects the machinery from shocks and strains due to misalignment of shafting, wearing of bearings, settling of foundations, etc., thereby lengthening its life and increasing its all round efficiency.

Many thousands of these Couplings are in use and they are strongly recommended as a serviceable and reliable Coupling for non-reversing duty.

STEELE & COWLISHAW, COOPER ST., HANLEY, STOKE-ON-TRENT.

PATENT CUTTER HOPPER DREDGERS,
BUCKET AND PATENT DIPPER DREDGERS,
FLOATING CRANES, GOLD & TIN RECOVERY
DREDGERS, AND DRAG LINE DREDGERS.

New Buckets, Links, Pins, Gearing, etc., supplied for existing Dredgers.

FLEMING & FERGUSON, LTD.,

Shipbuilders and Engineers, PAISLEY, SCOTLAND. Estab. 1878.
Telegrams: "PHŒNIX, PAISLEY" Telephone No.: PAISLEY 2648.
London Agents: Messrs. Nye & Menzies, Capel House, 62, New Broad St.,
London, E.C 2. Telephone No.: LONDON WALL 5846.

MERRYWEATHER
LIGHT PORTABLE WATER TUBE
BOILERS

Made in many sizes, from 2 to 200 H.P. For Coal, Wood, Oil, Gas or other Fuel,
FOR
UP-COUNTRY, MINING, MARINE, INDUSTRIAL
AND OTHER PURPOSES GENERALLY.

Copy of the new catalogue, No. 384 J, containing full particulars and 50 illustrations, will be forwarded post free on application to:

MERRYWEATHER & SONS, LTD.
Incorporating Shand, Mason & Co.,
GREENWICH, LONDON, S.E. 10.

Get on to
Willcox's
HOP 3140 (SEVEN LINES)

and ensure prompt attention to enquiries and orders for—

ENGINALITIES (rd.)
including:

Hand-sewn LEATHER BELTING;
"Balatite" (rd.) BALATA BELTINGS;
High-grade LUBRICATING OILS & GREASES; PACKINGS & JOINTINGS;
HOSEPIPES; SEMI-ROTARY PUMPS;
BOILER MOUNTINGS and all

ENGINEERS' STORES, TOOLS & SUNDRIES!

ILLUSTRATED LISTS
gladly sent upon request.

W. H. WILLCOX & CO., LTD.
GENERAL ENGINEERS' STORES,
32-38, SOUTHWARK ST., LONDON, S.E.1.

FORGINGS

WILLIAM B. CULL & SON, ENGINEERS & GENERAL SMITHS, ALSO GENERAL MACHINISTS.
TENNANT ST., BIRMINGHAM.
Telephone: MIDLAND 932. ESTABLISHED 1875.

PLENTY
& SON LIMITED
Telephone: Newbury 7 Telegrams: Plenty, Newbury
NEWBURY, ENGLAND

Contractors to the Admiralty and War Office, India and Colonial Offices and all Foreign Governments

Engines for Steam Yachts, Tugs, Coasters, Oil Tankers, Stern Wheelers and Side Paddle Steamers . . . . . .

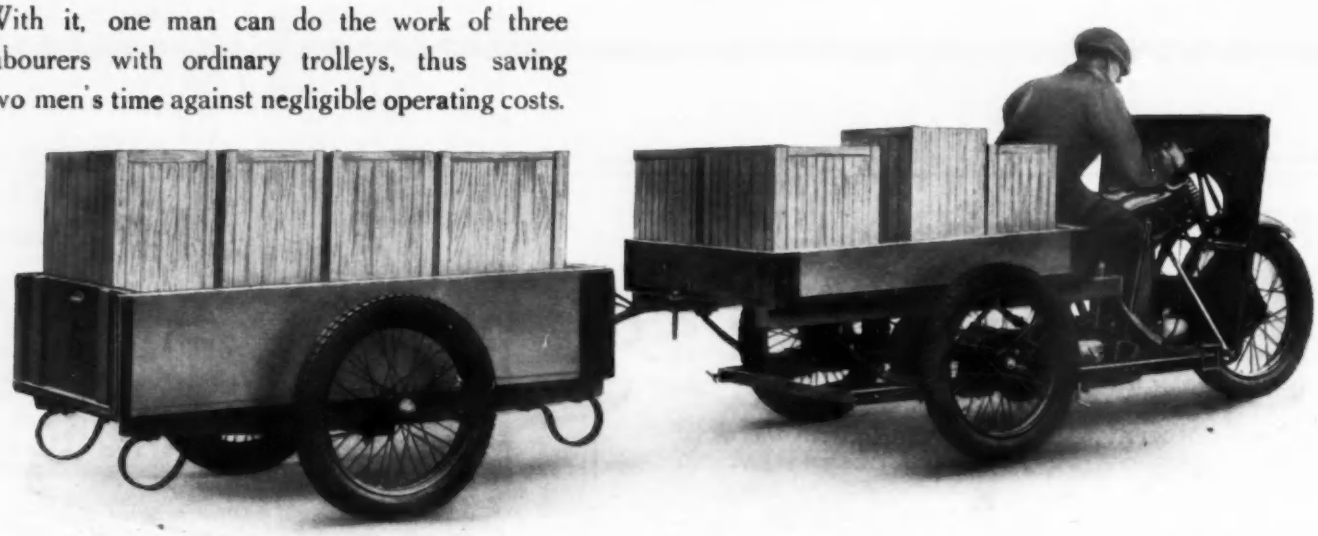
BRICK TILE & PIPE MACHINERY
JOHN WHITEHEAD & Cº LTD ALBERT WORKS PRESTON

Cut your Internal Transport Costs!

Efficient transport at low cost.

A 3-wheeled, low-loading motor truck and trailer having a combined capacity of 8 cwts. Faster than electric traction, easily controlled and equally suitable for long or short journeys on the road or for use in the shops, this truck does all the internal transport in factories.

With it, one man can do the work of three labourers with ordinary trolleys, thus saving two men's time against negligible operating costs.



The Trade Mark of Quality. Raleigh products are world-famous for their precision of construction, service and reliability.

Special features of The Raleigh Truck.

6 h.p. ENGINE.
Silent, smooth-running and absolutely reliable. Automatic dry-sump lubrication. Very simple to decarbonise and maintain.

3 SPEEDS and REVERSE.
Primary drive by heavy roller chain to 3-speed and reverse gearbox which incorporates a sweet, non-destructible clutch, and is specially designed for easy gear-changing.

DIFFERENTIAL REAR AXLE.
Final drive by "Duplex" roller chain to car type rear axle fitted with enclosed differential for easy cornering. Shafts carried on substantial taper roller bearings.

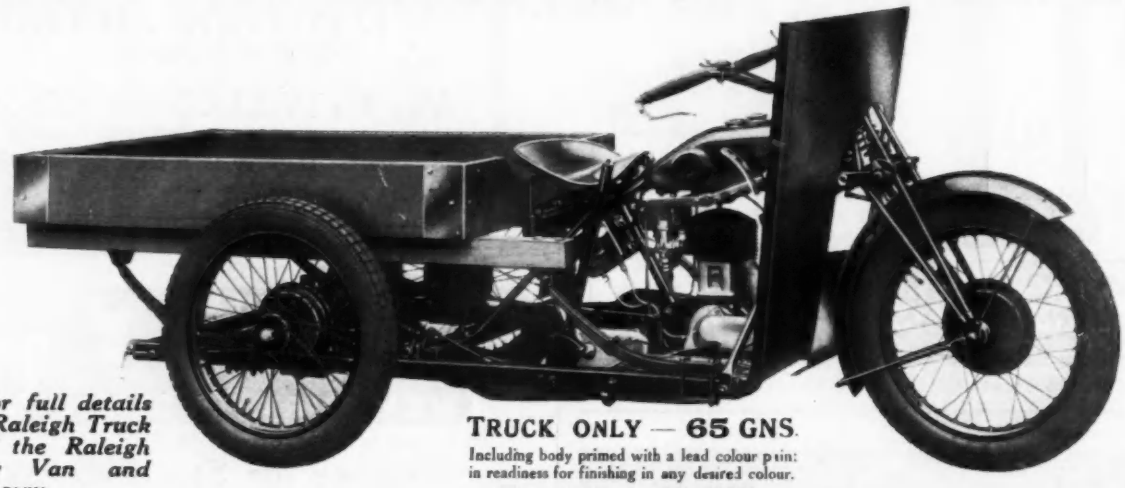
BRAKES ON ALL WHEELS.
Powerful internal expanding brakes 7½in. diameter. Front operated by handlebar lever, rear by pedal, inter-connected with hand lever for parking.

SMALL TURNING RADIUS.
While possessing 3 forward speeds and a reverse gear, the Raleigh Truck can be turned in practically its own length—a great advantage in small shops.

EASY STARTING.
Conveniently placed kick-starter can be operated from the saddle and instantaneous starting is ensured.

Capacity of Truck — 5 cwts. Capacity of Trailer — 3 cwts.

THE RALEIGH TRUCK



Send for full details of the Raleigh Truck and of the Raleigh Delivery Van and Light Lorry.

TRUCK ONLY — 65 GNS.
Including body primed with a lead colour paint in readiness for finishing in any desired colour.
TRAILER — 12 GNS.

THE RALEIGH CYCLE CO., LD. - - - NOTTINGHAM

For Pulverised Coal Firing Equipment

specify

HOWDEN BUELL & BRITISH REMA SYSTEMS

EXPERIENCE POINTS TO

FOR EFFICIENCY · RELIABILITY · LOW MAINTENANCE COSTS

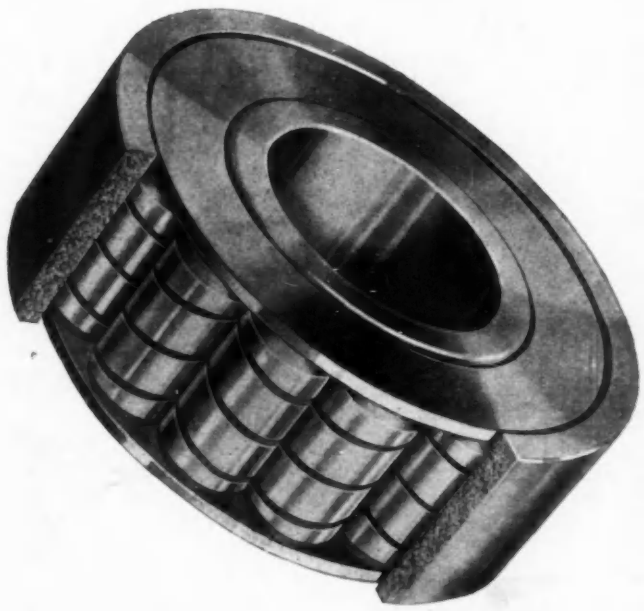
SH

SAMUEL HODGE & SONS LTD

SAMUEL HODGE & SONS, LTD.
130-132, LEADENHALL ST., E.C.3

Telephone—Avenue 8688. *Telegrams—Interknit, Stock, London.*

Branches: Glasgow, Birmingham, Cardiff, Australia, New Zealand, India, South Africa.



All mechanical handling equipment needs the protection assured by the application of HYATT Roller Bearings.

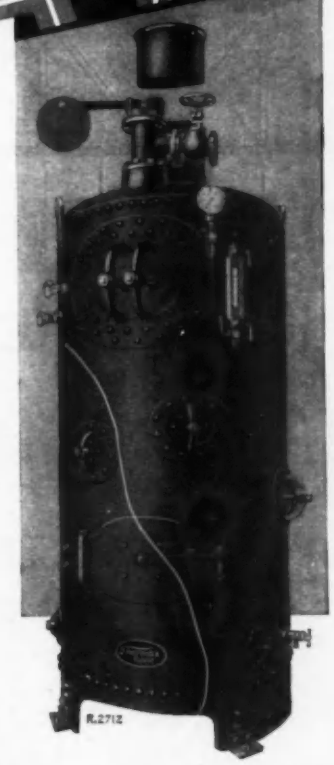
Longer bearing life, capacity to withstand punishment and unusual strains, freedom from constant oiling, adjustments and shut-downs for repairs, are but to mention a few of the many definite advantages of Hyatt protection.

Remember to specify GENUINE Hyatt only.

HYATT
Roller Bearings

DELCO-REMY & HYATT LTD.,
111, GROSVENOR RD., LONDON, S.W.1. Made in U.S.A.

HERE'S A RECORD



An Engineer writes:—

"This Thermax Boiler has given an evaporation far in excess of what you claimed for it and has exceeded our expectations in effecting a fuel saving of over 20%."

RUSTON

Thermax

BOILERS

Made in sizes 2' 9" dia. × 6' 9" high to 7' dia. × 16' high with evaporative capacity from 420 to 5000 lbs. per hour.

WELDED WORK.

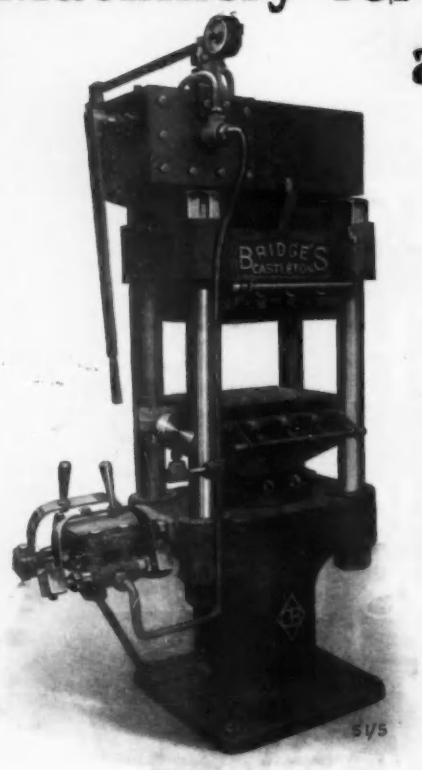
We specialise in the manufacture of welded steel parts, any design, any weight, and for any service.

Ask for photographs showing welded steel products produced in our works.

RUSTON & HORNSBY LTD., LINCOLN.
LONDON - - Imperial House, 15-17-19, Kingsway, W.C.2.

B

Bridge's Modern Rubber Machinery for Plantation and Factory



• • •

ILLUSTRATION of an 18" × 14" Hydraulic Press with gas heated plates. Operated by Hand Pumps.

• • •

WE make Rubber Machinery in all its branches for Manufacturers, Planters, etc. Also Machinery for all classes of Plastics, Gutta Percha, Balata, Cable Making Machinery, Hydraulic Presses, Pumps, Accumulators, Transmission Gearing, etc. etc.

Write for Illustrated Catalogue. Sent Post Free on request.

DAVID BRIDGE & Co. LTD.
Castleton. Manchester.
London Office — 35, Queen Victoria St. E.C.

100 H.P. Double-Geared

"Sentinel" Patent Locomotive

as supplied to the

LONDON & NORTH EASTERN RAILWAY.
LONDON MIDLAND & SCOTTISH RAILWAY.
TANGANYIKA RAILWAYS and many others.

Tractive effort on low gear 11,750 lbs. up to 2½ m.p.h.
Speeds on high gear up to 25 m.p.h.

"SENTINEL" PATENT LOCOMOTIVES are built for all gauges, of weights from six to thirty-five tons, and from eighty to two hundred horse power.

For full particulars write to:

The "Sentinel" Waggon Works, Ltd.
Railway Department,
20, Iddesleigh House, Caxton Street, London, S.W. 1.
Telephone: Victoria 4650. "Sentnoll, Sowest, London."

ELEVATORS & CONVEYORS OF ALL TYPES. WAGON TIPPERS, RECIPROCATING & ROTARY SCREENS, COAL BREAKERS & FEEDERS.
COKE STORAGE BY CRANE & TELPHERAGE WITH AUTOMATIC SKIP FILLERS. COAL AND COKE BUNKERS. HANDLING PLANT FOR ANY MATERIAL.
WEST
Coal & Coke Handling Plant
THE WEST LIP-BUCKET CONVEYOR FOR COAL AND COKE

Telephone: COLLYHURST 2961 (3 lines)
Telegrams: "STOKER, Manchester."

WEST'S GAS IMPROVEMENT CO., LTD.

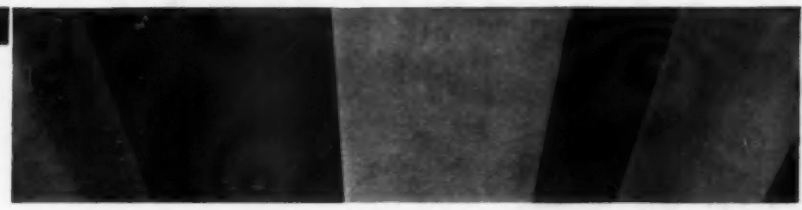
Miles Platting
MANCHESTER.

LONDON:
Regent House, Kingsway, W.C. 2.
Tel. Add.: "Imvertret, Westcent, London."
Telephone: Holborn 4108.

PARIS:
Cie. Gle. de Construction de Fours, 8, Place des Etats-Unis, Montrouge (Seine).
Tel. Add.: "Cormiques-Montrouge (Seine)."
Telephone: Vaugirard 27-95 and 27-96.

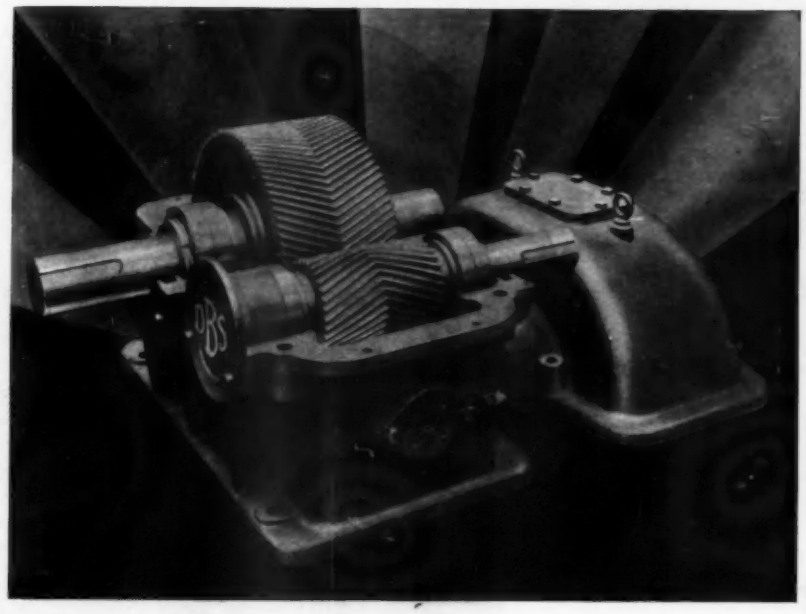
NEW YORK (U.S.A.):
West Gas Improvement Co. of America Incorporated, 441, Lexington Avenue, New York.
Tel. Add.: "Verticals, New York."
Telephone: Murray Hill 2-7242.

SYDNEY:
Union House, 243, George St., Sydney, N.S.W.
Tel. Add.: "Vertical, Sydney."
Telephone: B5865.



Standardised

SPEED REDUCERS



In a complete range of types

David Brown Standardised Speed Reducers form a very convenient and quickly installed means of driving individual machines from electric motors. They simplify the design of the machines, render them easily adaptable to the most convenient or economical speed, save floor space, and cost less in power and maintenance than other forms of drive.

The David Brown Range covers practically all industrial requirements. It includes worm and helical speed reducers with single, double and triple reduction, turbine speed reducers and new types of geared motor units embodying flange mounted motors bolted direct to the gear housing.

When full particulars regarding the operating conditions are given, and a David Brown Speed Transformer is offered to meet these conditions, it automatically carries the DBS Five Years' Guarantee.

We shall be glad to co-operate in the design and application of David Brown Gears for any industrial transmission—please send us your enquiries.

DAVID BROWN & SONS

(HUDD'FD) LTD., HUDDERSFIELD.

Coils of every description

made from

WROUGHT IRON

or

STEEL TUBES

with any type of Joint

The coil illustrated consists of 9 spirals each of 10 turns, nested together and welded into one inlet and one outlet header. The whole is continuous without any joint. The four sets of steel spacing plates are grooved to fit the tubes, and although the diameter of the largest coil is 6 feet, the tolerance on the diameter of each coil is only 1/16 in.

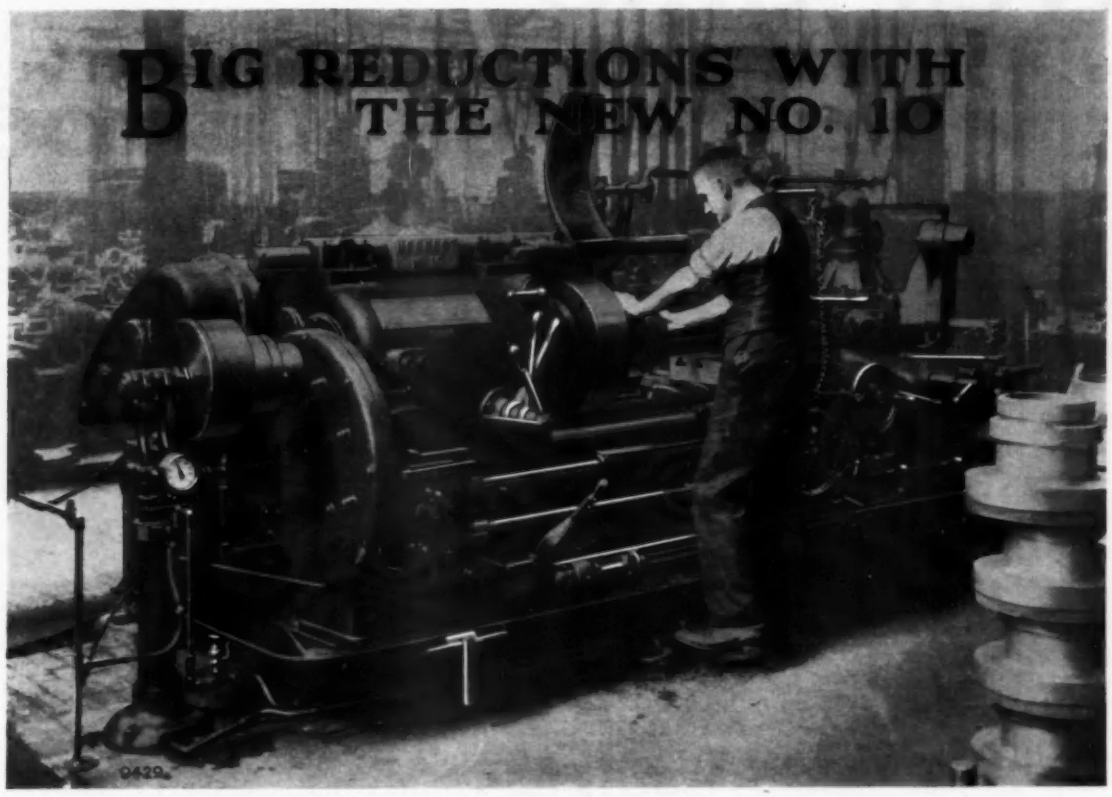
Your requirements, however unusual and exacting, can be satisfactorily met.

Send us your enquiries.

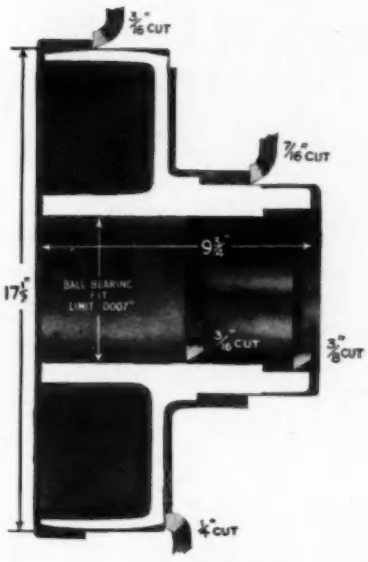
STEWARTS AND LLOYDS LTD

GLASGOW BIRMINGHAM LONDON

HERBERT



The new Herbert No. 10 Combination Turret Lathe, 20¼in. swing. Covered bed, roller bearing spindle, ball or roller bearings throughout. Automatic lubrication. Independent feeds to saddle and turret slide. The 18in. Herbert Air Chuck with foot control greatly reduces chucking time.



THE cast iron pulley illustrated is machined all over in 37 minutes on the new Herbert No. 10 Combination Turret Lathe.

Five cuts totalling a depth of $1\frac{7}{16}$in. are taken simultaneously. Cutting speed on outside diameter is 250 feet per minute. Feed of turret 33 cuts per inch. Feed of cross slide 26 cuts per inch.

We are obtaining some remarkable results on this machine in our works.

It is worth a visit to Coventry to see it in operation.

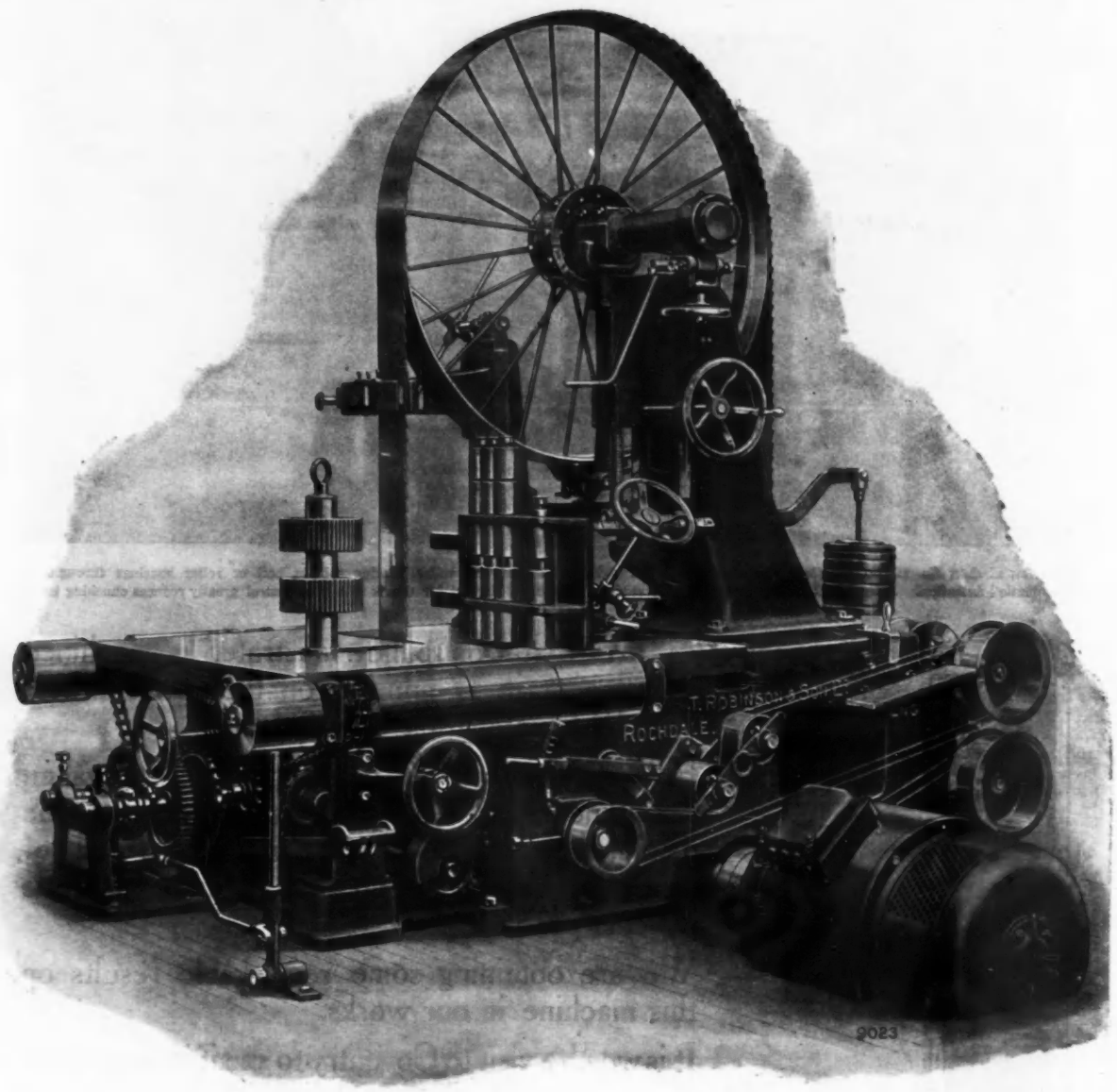
IMMEDIATE DELIVERY.

ALFRED HERBERT LTD COVENTRY

THE SCOTTISH TUBE Co., Ltd., 34, ROBERTSON STREET, GLASGOW

Saves time

Saves timber



Robinson Band Re-Saw Type M.F.

Saves time
because it is designed for very high feed speeds up to 250 feet per minute

Saves timber
owing to the extreme accuracy with which the boards are turned out.

Built with pulleys 48", 54", 60" and 72" diameter and of various capacities up to 36" depth of cut.

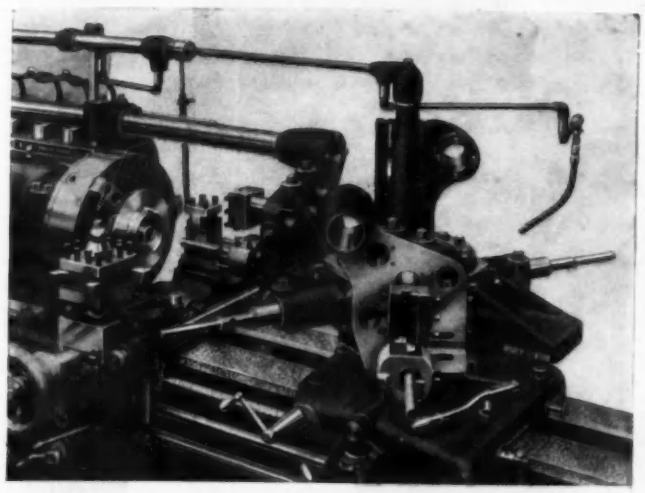
Thomas Robinson & Son, Ltd. Rochdale, England.

London :—Abbey House, 2, Victoria Street, S.W. 1.

ASSOCIATED BRITISH MACHINE TOOL MAKERS L.TD

17, GROSVENOR GARDENS. LONDON, S.W.1.

Ward CAPSTAN & TURRET LATHES



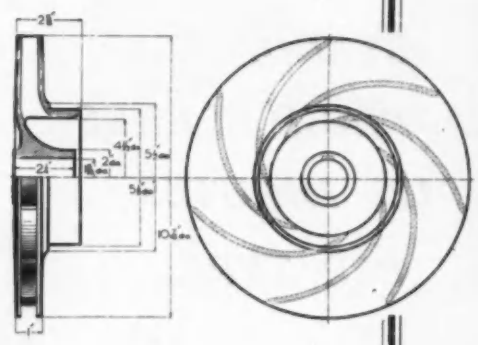
No. 8 COMBINATION TURRET LATHE.

CAPACITY:—

Height of centre	8¼"
Swing over shears of bed	17"
Swing over top of cross slide	9¾"
Diameter of hole through spindle	3¼"
Length of longitudinal automatic feed	36"
Maximum distance between spindle nose and turret	51"

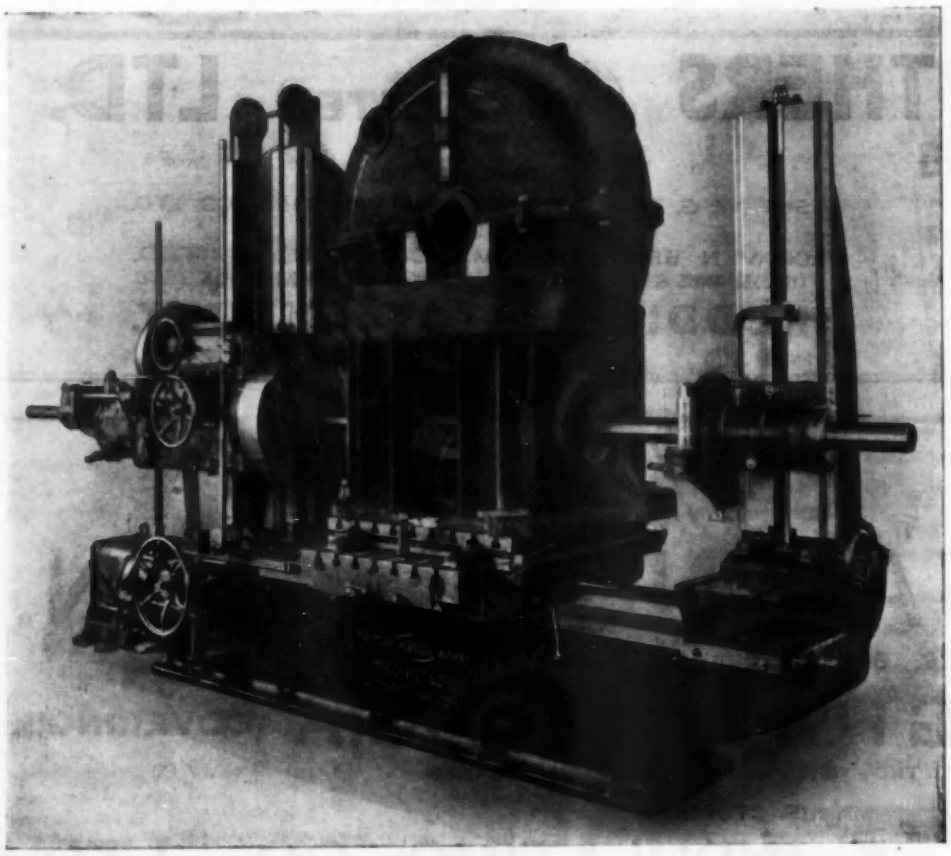
THE No. 8 Combination Turret Lathe has bar capacity up to 3¼" and chuck capacity up to 9¾" over cross slide and 17" over the bed.

THE line drawing represents a gun-metal water impeller, which is completely machined in two operations. A special tool arrangement was necessary for the taper faces.



H. W. WARD & Co. LTD., DALE ROAD, SELLY OAK, BIRMINGHAM

THE PEARN-RICHARDS MACHINE



in operation on a large Worm Reduction Box

YOUR work will be done quicker and to a higher degree of accuracy on a RICHARDS HORIZONTAL BORER

These Machines are in use throughout the world in almost every branch of engineering, and we are constantly receiving repeat orders.

Made in six sizes, either with or without traversing spindle, and all Machines are built to guaranteed fine limits of errror.

WRITE TO-DAY FOR FULL PARTICULARS TO

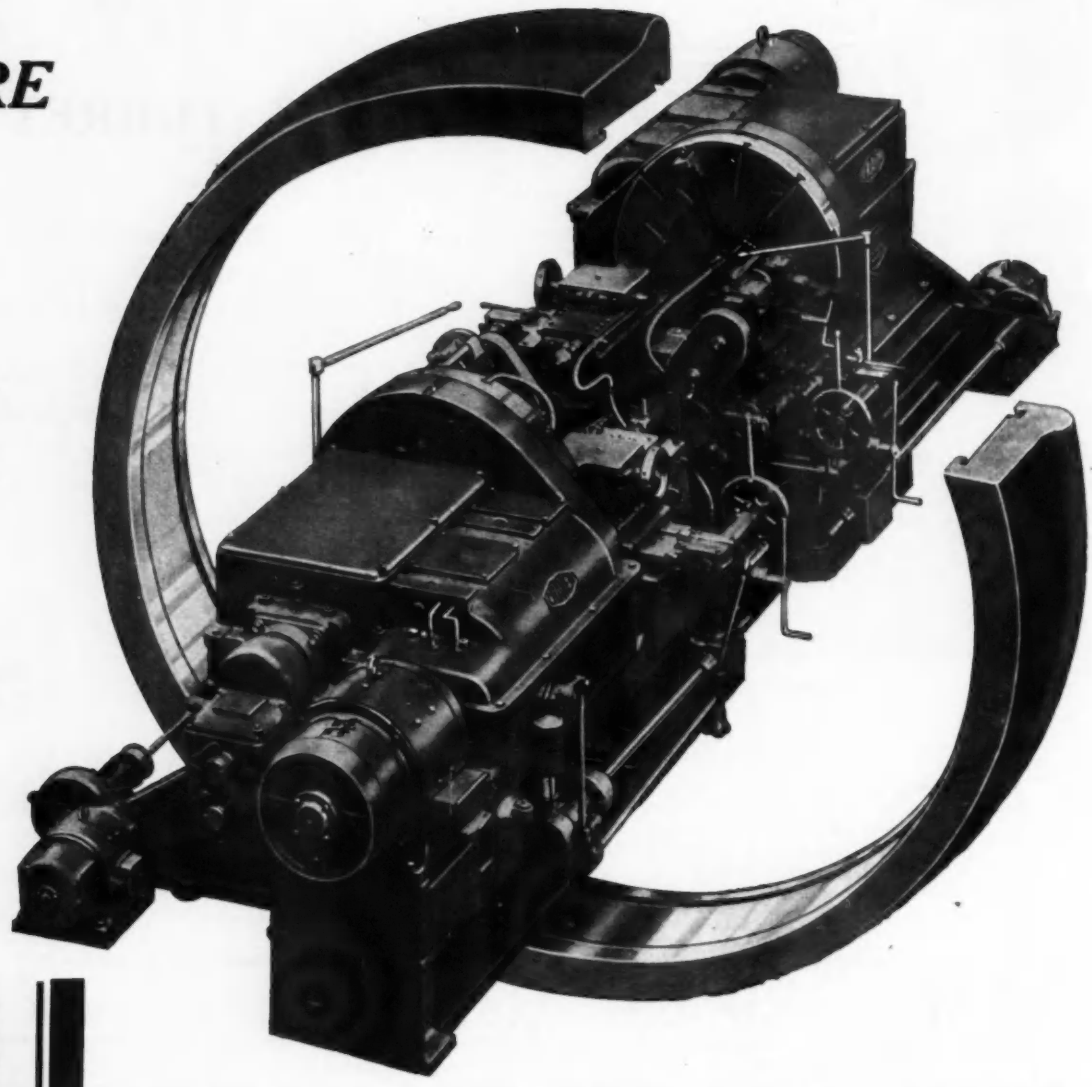
THE ORIGINAL MAKERS

GEO. RICHARDS & Co. LTD. BROADHEATH, NR MANCHESTER.

CRAVEN

DUPLEX TYRE BORER.

FLOOR TO FLOOR
PRODUCTION TIME
ON
STANDARD
CARRIAGE TYRES
12½ MINUTES
PER TYRE.



THE MACHINE WHICH IS REVOLUTIONISING
RAILWAY TYRE PRODUCTION.

CRAVEN BROTHERS (MANCHESTER) LTD.

INCORPORATING:-
SIR W. G. ARMSTRONG WHITWORTH & CO. LTD.
(MACHINE TOOL DEPT.)
CRAVEN BROTHERS (MANCHESTER) LIMITED.
THOS. SHANKS & CO. (1928) LTD. JOSHUA BUCKTON & CO. LTD.
REDDISH, STOCKPORT.

85%
MAGNESIA INSULATION.

HIGH TEMPERATURE COVERINGS. SLABS, SECTIONS, PLASTIC HARD SETTING COMPOSITION.

SPECIFY "DARLINGTON MAGNESIA" COVERINGS.

MADE BY THE WELL-KNOWN PATTINSON PROCESS.

MANUFACTURED BY

THE CHEMICAL & INSULATING CO., LTD.,
DARLINGTON.

Telephone :
DARLINGTON 2652.

Telegrams :
"DEXTRO, DARLINGTON."

PRESSINGS

We are exhibiting at the British Chemical Plant Exhibition, London, July 13th—18th.

See our STAND Nos. B 13 and B 25.

STAYBRITE – STAYBRITE – STAYBRITE! How incessantly the word recurs in all discussions of plant for almost every industry these days. Specifications call for Staybrite–specifications which provide successfully for the defeat of rust–and plant manufacturers are to-day realising more and more the advantages of using this Acid-Resisting Steel.

The Engineering and Chemical industries have welcomed Staybrite–they have found in Staybrite the one efficient means of combating corrosion, owing to its wonderful immunity to acids, chemicals and other corrosive media. Tanks–ducts–steam coils–pressings–innumerable applications to these and many other industries are all to be had now in Staybrite–the corrosion-resisting steel which you will ultimately specify.

Below is a reproduction of a Steam Jacketed Boiling Pan made from Staybrite by Messrs. H. Braithwaite & Co., Ltd., Leeds.

May we send you full details of this remarkable acid-resisting steel? Our booklet No. 279 gives a list of acids and other media to which it is immune.

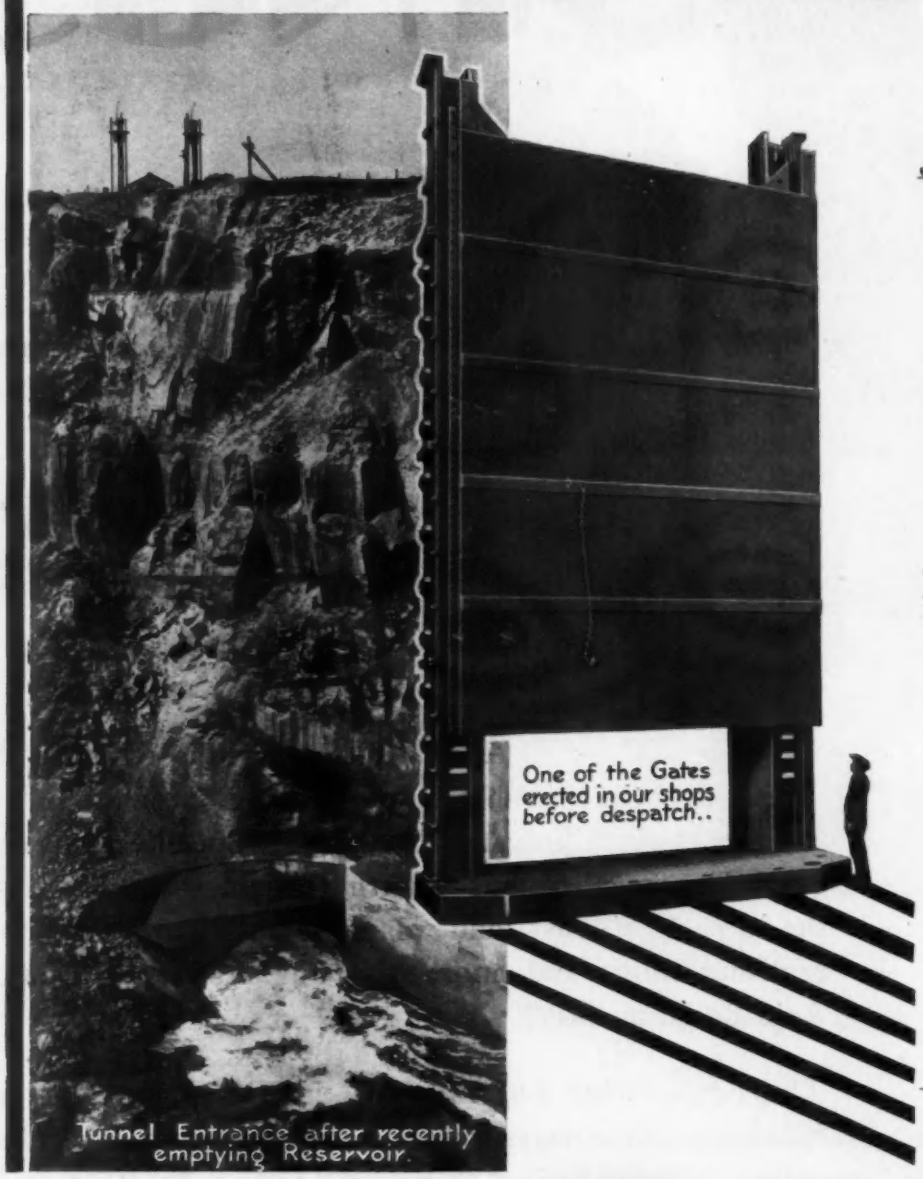
STAYBRITE

TRADE MARK

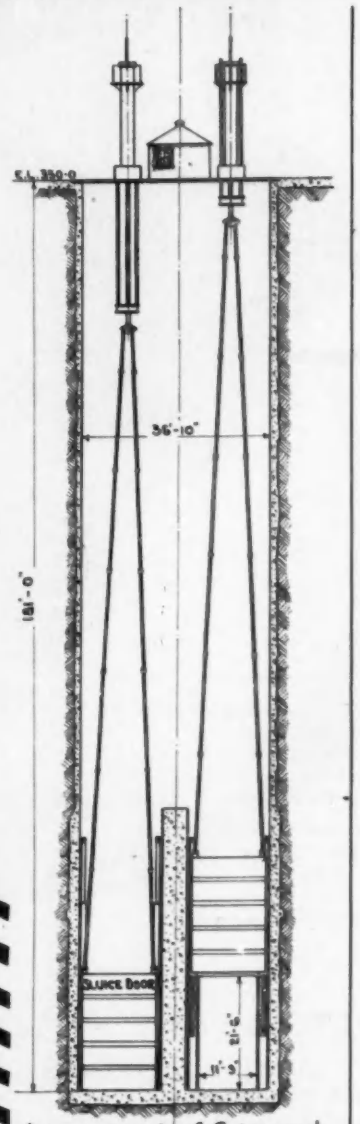
THOS. FIRTH & JOHN BROWN LTD., ATLAS and NORFOLK WORKS, SHEFFIELD.

C

GLENFIELD TUNNEL SLUICES



Tunnel Entrance after recently emptying Reservoir.



Arrangement of Gates and operating Gear.

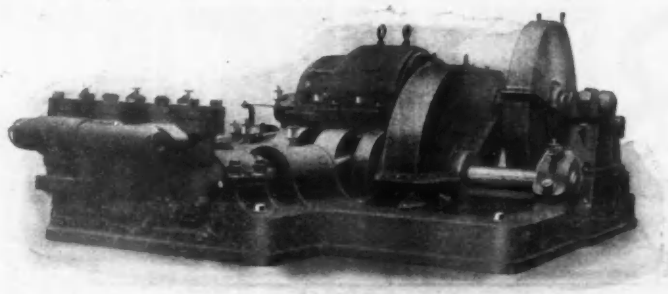
Recent events have necessitated emptying the reservoir through the diversion tunnel, which is controlled by our sluices.

Various causes made the conditions particularly severe, and we are informed that, due to their very robust construction, the gates functioned perfectly throughout.

AT ARAPUNI NEW ZEALAND

GLENFIELD & KENNEDY LTD. KILMARNOCK, SCOTLAND

HYDRAULIC MACHINERY



THE

HYDRAULIC ENGINEERING COMPANY, LTD.

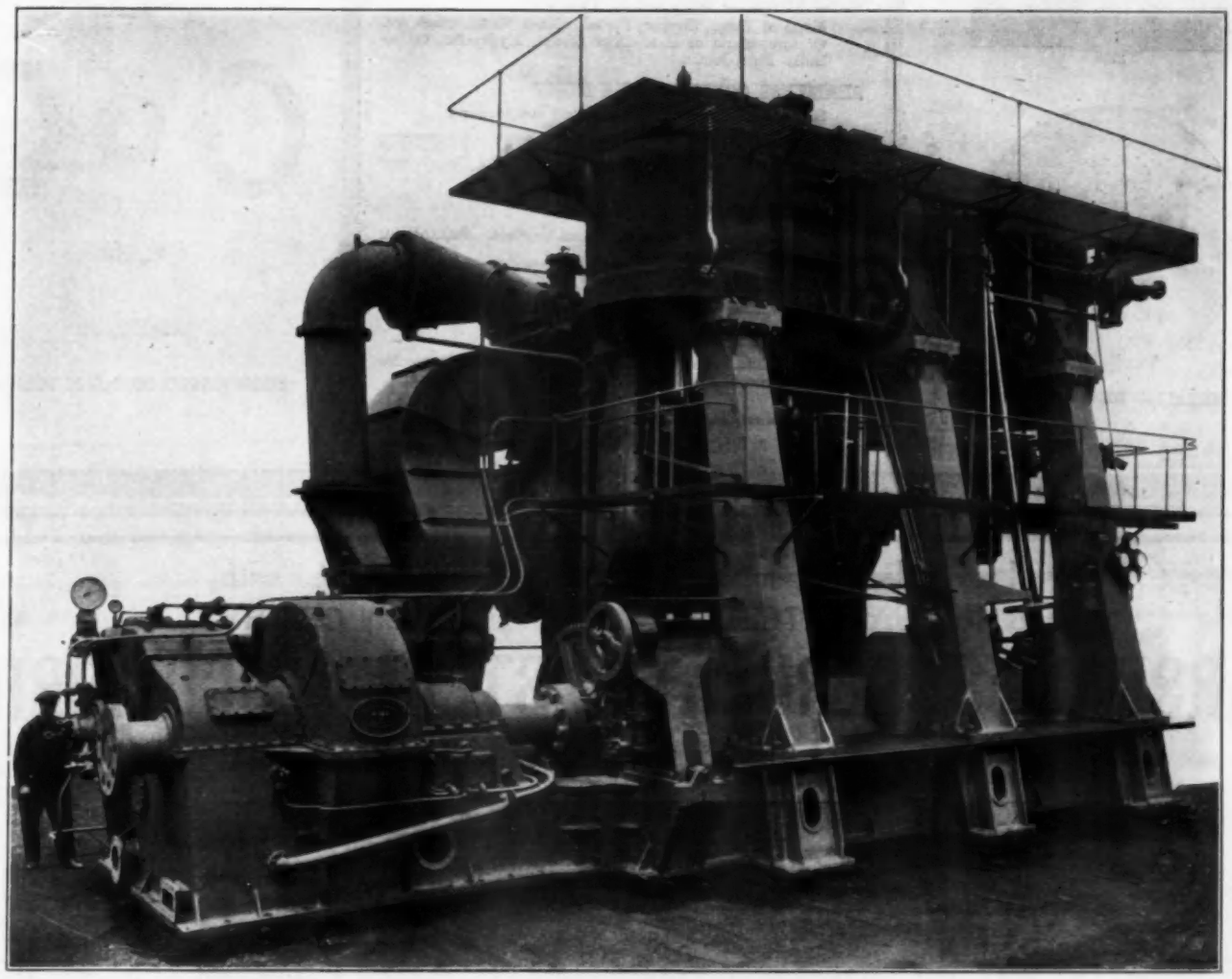
WORKS & HEAD OFFICES:
CHESTER.
Telephone: Chester 1421.
Telegrams: Hydraulic, Chester.

LONDON OFFICE:
39, VICTORIA STREET, WESTMINSTER, S.W.1.
Telephone: Victoria 2820.
Telegrams: Hydrochest, Sowest London.

THE WALLSEND SLIPWAY AND ENGINEERING COMPANY LTD.

Builders of

Steam Reciprocating, Turbine and Wallsend-Sulzer Diesel Oil Engines



TRIPLE EXPANSION ENGINE WITH BAUER-WACH EXHAUST TURBINE FOR AN OIL TANKER.

Boilermakers, Ship Repairers and Oil Burning Specialists.

Head Office and Works - - - WALLSEND-ON-TYNE.

LONDON OFFICE - - - 34, Great St. Helens, E.C. 3.

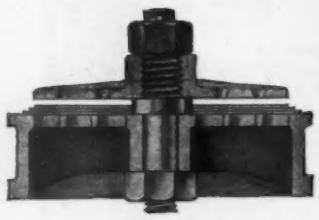
LIVERPOOL OFFICE - - - Cunard Building.

THE METALLIC MANUFACTURING Co LTD
Ardrossan Ayrshire

CONTRACTORS TO ADMIRALTY AND GOVERNMENT DEPARTMENTS.

TELEPHONE NO 39 ARDROSSAN

TELEGRAMS: JOINTING ARDROSSAN



METALLIC DISC VALVES.

MANUFACTURERS OF

METALLIC DISC VALVES
Multiplex dead-lift or Flexible types. For Air, Circulating, Hydraulic, Feed, &c., Pumps. Easily fitted to existing Pumps.
Supplied to over 300 Warships of the British Navy.

CORRUGATED METALLIC JOINTS
Made of Brass, Copper, Nickel, Monel Metal, Steel, &c. Of any shape or size. For Steam, Hydraulic, Oil or Blast Pipe Joints.

SEAMLESS COPPER JOINT RINGS
Soft annealed. Of all sizes, shapes and sections.

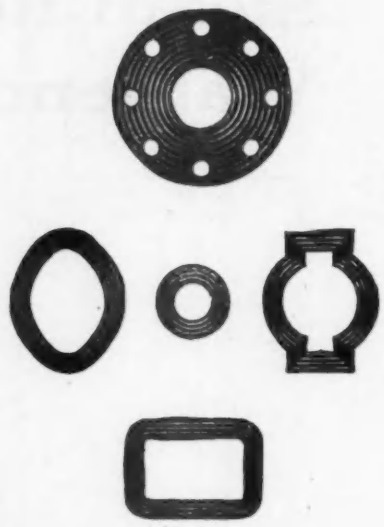
COPPER-and-ASBESTOS JOINTS AND WASHERS
For Steam and Water Pipe Joints. Motor Car, Diesel and Aero Engines.

FIBROUS METALLIC PACKING
For Glands of all types of Steam Engines. Suitable for High or Low Pressures.

LEAD FIBRE
For Jointing Gas or Water Cast Iron and Steel Mains.

MANGANESE JOINTING PASTE
For Steam, Water or Gas Joints. Specially suitable for use in conjunction with Corrugated Metallic Jointing.

Illustrated Catalogue on application.



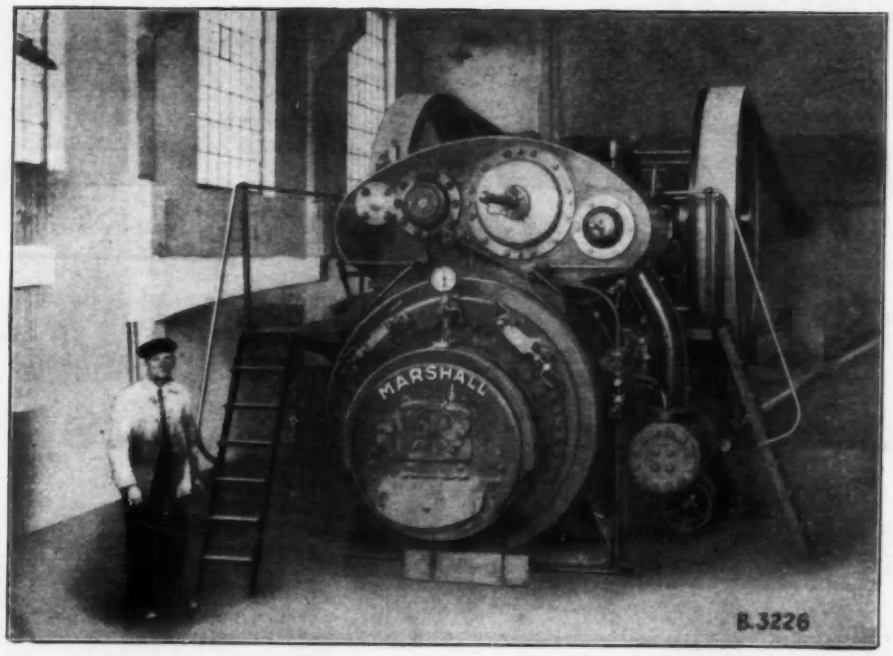
CORRUGATED METALLIC JOINTS.

How does your fuel consumption compare with
THE GUARANTEED COAL CONSUMPTION OF THE

MARSHALL SUPERHEATED STEAM "LOCOMOBILE"

which is **1·1** lbs. per brake horse power per hour.

Sizes:
55 to
325
B.H.P.



Reliable
Power at
LOWEST
COST.

Inquiries invited.

Ask for List No. 1967.

SAVES IN FIRST COST :: SAVES IN FLOOR SPACE ::
AND SAVES AT A REMARKABLY HIGH FIGURE IN COAL COSTS.

MARSHALL, SONS & COMPANY, LTD., ENGINEERS, GAINSBOROUGH.

FIGHT DEPRESSION WITH THE LATHE OF THE PRESENT AND FUTURE.

Are you quite sure you are using the Lathe of to-day instead of the Lathe of yesterday?

Many firms are endeavouring to meet competition with inefficient old lathes. As is realised by all modern Engineers this policy is foredoomed to failure, though unfortunately this is seldom observed until it is too late.

Our Lathe is truly called the Lathe of the Present and Future, not without just cause.

Outstanding among its unrivalled advantages are:—

Every part machined from jigs giving absolute interchangeability.

Ease of control by means of mechanical movement.

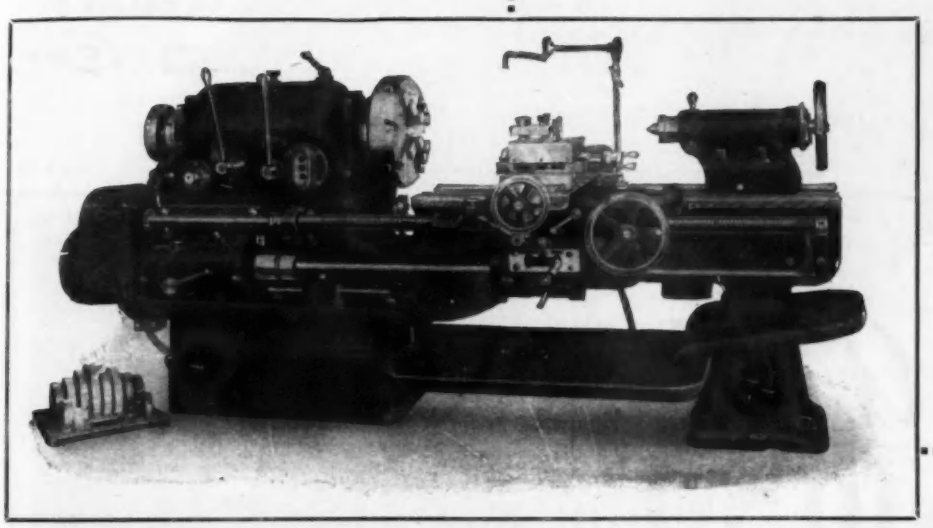
Fool-proof interlocking motions in apron and all other necessary places.

Hardened burnished gears (in headstock).

Flanged spindle nose, giving greater rigidity when under cut.

And many other outstanding points with which we should be pleased to acquaint you.

Why not obtain further particulars of this machine?



DEAN, SMITH & GRACE, LTD.,
KEIGHLEY, YORKS.

V·S·G

HYDRAULIC VARIABLE SPEED GEAR

THE IDEAL MEDIUM FOR CONTROLLING SPEED.

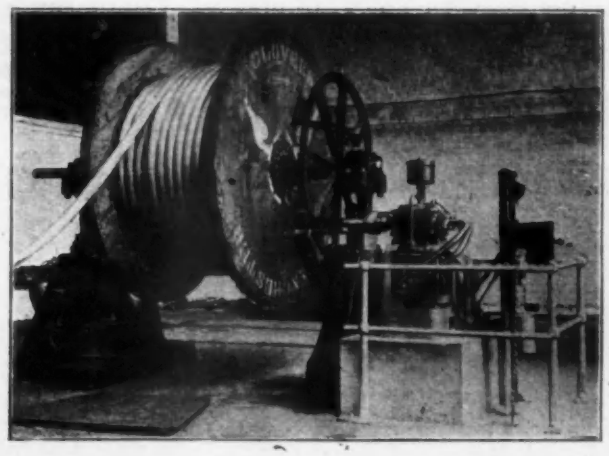
PERFECT AND POSITIVE CONTROL FROM ZERO TO FULL SPEED, FORWARD AND REVERSE, WITHOUT STEPS.

SIMPLE AND SELF-CONTAINED.

VARIETY OF CONTROL TO SUIT ALL REQUIREMENTS.

HIGH STARTING TORQUE.

SUITABLE FOR ALL CONDITIONS.



Also
VSG VARIABLE DELIVERY PRESSURE PUMPS.

The illustration shows an example of a VSG Drive applied to a Cable Haul-off Drum, coiling cable from Lead Covering Press.

Send enquiries to:

THE VARIABLE SPEED GEAR LIMITED

6, BROADWAY, WESTMINSTER, LONDON, S.W. 1.

Works: ELSWICK WORKS, NEWCASTLE-ON-TYNE.
Telephone: NEWCASTLE 33101. *Telegrams:* VARISPEED, NEWCASTLE-ON-TYNE

Telephone - - VICTORIA 6900.
Telegrams - - VARISPEED, SOWEST, LONDON.

THE LONDON & LANCASHIRE INSURANCE Co LTD

ENGINE and BOILER

INSURANCES

A staff of fully qualified ENGINEER SURVEYORS is at your service

CHIEF ADMINISTRATION—
7, CHANCERY LANE, W.C. 2.

OXO

Part of an installation of 13 Electric Cranes at Messrs. Oxo's new wharf on the Thames.

BEDFORD ENGINEERING CO.
(Claude M. Toplis),
BEDFORD.

You want good and quick Service.
This is where you can get it.

The STANDARD PISTON RING & ENGINEERING Co., Ltd.,
Telephone: 41874 *ATTERCLIFFE.*
Telegrams: "OCEAN," *SHEFFIELD.*
PREMIER WORKS, DON ROAD, SHEFFIELD.

There is the specialized experience of 40 years behind the manufacture of these piston rings, and the special material they are made of, and more than 7000 satisfied users.

FIT STANDARD 'S.

And be insured against all risks.

That is why "STANDARD'S" Cast Iron hammered piston rings are always the best.

ACCURACY (Faces ground to half thou's.)
DEPENDABILITY.
RAPID DELIVERY
are our watchwords.

Save
30% to 50%
IN
AIR COSTS

Thor **COCHISE ROCK DRILLS**

One of the most important features of THOR COCHISE ROCK DRILLS is the great saving in air consumption they make possible. Under actual drilling operations they will save from 30% to 50% in air costs and yet do more work.

This saving in air is made possible by the original COCHISE VALVE, which has proved to be so efficient that it has not been necessary to change the design in any detail for a long period of years.

THOR COCHISE ROCK DRILLS are exceptionally speedy in operation, rugged in design, and simple in construction. And the maintenance costs are remarkably low.

Bulletin 27 gives complete details of THOR COCHISE ROCK DRILLS and STOPERS. A request will bring you a copy by return post.

INDEPENDENT PNEUMATIC TOOL CO.
Incorporated in U.S.A. with Limited Liability.
40, BROADWAY, WESTMINSTER, LONDON, S.W. 1.
Telephone: Victoria 6655. *Telegrams: "Thortool," Sowest, London.* *Cables: "Thortool," London.*

"English Electric" MOTORS FOR EVERY INDUSTRIAL DRIVE

Pipe-Ventilated Slipring Motor

Protected Type Small and Large Squirrel-Cage Motors

Protected Type Slipring Motor

"Closvent" Enclosed Squirrel-Cage Motor

Louvre-Ventilated Squirrel-Cage Motor.

Power users the World over testify to the reliable and efficient service of "English Electric" Motors under the most exacting and arduous industrial conditions.

Write for our Pocket Price List 1026

ENGLISH ELECTRIC
THE ENGLISH ELECTRIC COMPANY LIMITED.
HEAD OFFICE:
Queens House, Kingsway, London, W.C.2

Works: BRADFORD, COVENTRY, PRESTON, RUGBY, STAFFORD.

MARSHALL, FLEMING & CO., LTD., ENGINEERS and CRANE MAKERS

LONDON OFFICE—
Grand Buildings,
Trafalgar Square, W.C.2.

MOTHERWELL.

NEWCASTLE-ON-TYNE OFFICE—
1, St. Nicholas Buildings.

100-Ton Five-Motor Ladle Crane, 75 feet span.

THE WELLS' SYSTEM OF SPRAY PAINTING.

THE
New Model Pistol Type No. 3.

Deals efficiently with Oil & Lead Paints, Varnishes, &c. Particularly adapted for Cellulose Painting of every description where high-class finish is essential.

BRITISH MANUFACTURE.

Portable & Stationary Plant supplied according to requirements.

MINERS' ACETYLENE LAMPS.

No. 35 c.p. 30 Burns 4 hours.
No. 36 c.p. 30 Burns 8 hours.
No. 37 c.p. 50 Burns 8 hours.

Strong, Simple and Reliable.

UNBREAKABLE OIL LAMPS

No. 13 GAS GENERATING LAMP.

100 Candle Power.
Burns 5 hours.
Capacity 5 Pints.

No. 20 Moulders' Lamp.

No. 18 Kettle Torch.

No. 18a Trench Lamp.

No. 1 Oil Feeder

No. 4 Hand Lamp.

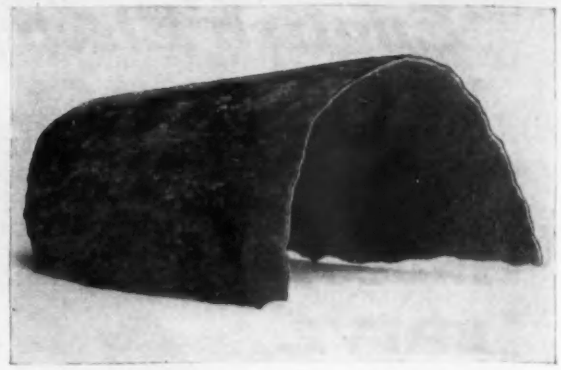
No. 5 Torch Lamp.

REMOVABLE BARREL POUR.

For emptying Casks.
Instantly attached and removed.
Ensures even flow.

A. C. WELLS & Co., Ltd.
Carnarvon Street, Cheetham, MANCHESTER.
London Office: 4, Bradleys' Buildings, White Lion Street, Islington, N.1.

Simply tap with a mallet
and Scale leaves like this—



Above is a photograph reproduced by courtesy of Messrs. J. Lyons & Co., Ltd., which shows how easily scale is removed from interior boiler surfaces that have been treated with "Apexior."

WHEN the steam and water surfaces of boilers are painted with "Apexior Compound" little more than a mallet is needed for scaling.

Surfaces coated with "Apexior" are antagonistic to the building up of scale by the crystallisation process; the quantity of scale deposit is considerably lessened and entirely altered in character, being loose in texture and friable. Scale does not adhere to "Apexiorised" surfaces—it comes away easily over large areas when tapped with a wooden mallet or flat-faced hammer, obviating the use of chipping hammers with all consequent possibilities of damage to plates.

"Apexior" is applied with a brush. One treatment on all surfaces in contact with steam or water gives effective protection for approximately one year at comparatively small cost. At least know how valuable "Apexior" is proving to be in most of the principal land and marine boiler installations.

¶ **Write for 10th Edition "Power and More Power" and "Nat. Physical Lab. Reports on Heat Transmission." State whether land or marine booklet desired. Free. Dept. J.**

J. DAMPNEY & CO., LTD..

PROTECTIVE COATINGS FOR METAL SURFACES.

BRITANNIC WORKS, NEWCASTLE-UPON-TYNE.

GWYNNE
SUCTION DREDGER

Complete with CUTTER GEAR

Supplied to a Corporation in the South of ENGLAND.

Send us your enquiries. Our unique experience is at your disposal.

GWYNNES PUMPS LTD

MAKERS SINCE 1849 OF CENTRIFUGAL PUMPS FOR ALL SERVICES

HAMMERSMITH
LONDON W 6
Telephone: Riverside 1910
Telegrams: Gwynne London

&

Hammersmith Works
LINCOLN
Telephone: LINCOLN 18
Telegrams: Gwynnes Lincoln

"B.B."

MALLEABLE

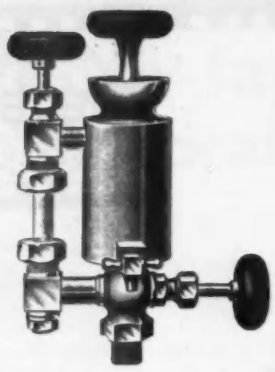
IRON

CASTINGS

BAGSHAWE

DUNSTABLE. & CO., LTD.

E. 186

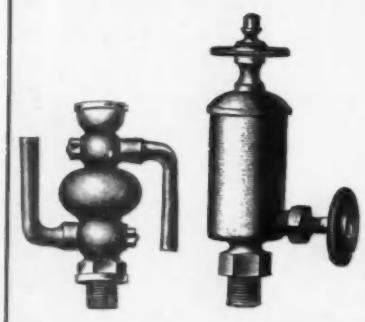


LUBRICATORS

WE SPECIALISE IN ALL TYPES OF LUBRICATORS, COMPRISING

Force feed, Displacement and Gravity type, Sight and Drop Lubricators, suitable for Steam and Gas Engines, Air Compressors, etc.

Prompt deliveries of Brass and Iron Stauffer Lubricators, Tallow Cups, Oil Syphons, Grease Lubricators in all sizes.



BRITISH STEAM SPECIALTIES, LTD.
Wharf Street, LEICESTER.

WALLWIN NON-CHOKEABLE PUMPS

For pumping—
Sewage, Sludge, Mud, Cotton Waste, Lumps of Hair, Rags, Slime, Refuse, etc., **continuously and efficiently.**

The NO-trouble Pump. It has been designed and made to do what *no* other pump can do—and it does it.

Be sure you get a Genuine Wallwin Pump, which is fitted with the one way in and one way out non-chokeable impeller.

Sole Makers— THE
WALLWIN COMPANY,
Manufacturing Engineers,
Saltisford Ironworks,
WARWICK, ENGLAND.

JOHN OAKEY & SONS LTD

Genuine Emery
Emery Cloth
Glass Paper
Flint and
Garnet Paper

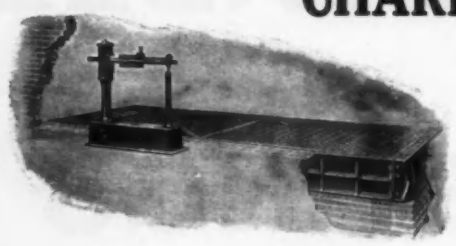
TAPES
Emery
Carborundum
Corundum
Garnet
Flint

N.B.—All Papers and Cloths are supplied in Rolls, Bands, Discs, Strips and Sheets of almost any size and shape, to suit the special requirements of buyers. Prices quoted on receipt of particulars.

Emery
Carborundum &
Corundum
Discs
of Cloth and Paper, for all Disc Grinding and Polishing Machines
Emery Wheels
Black Lead

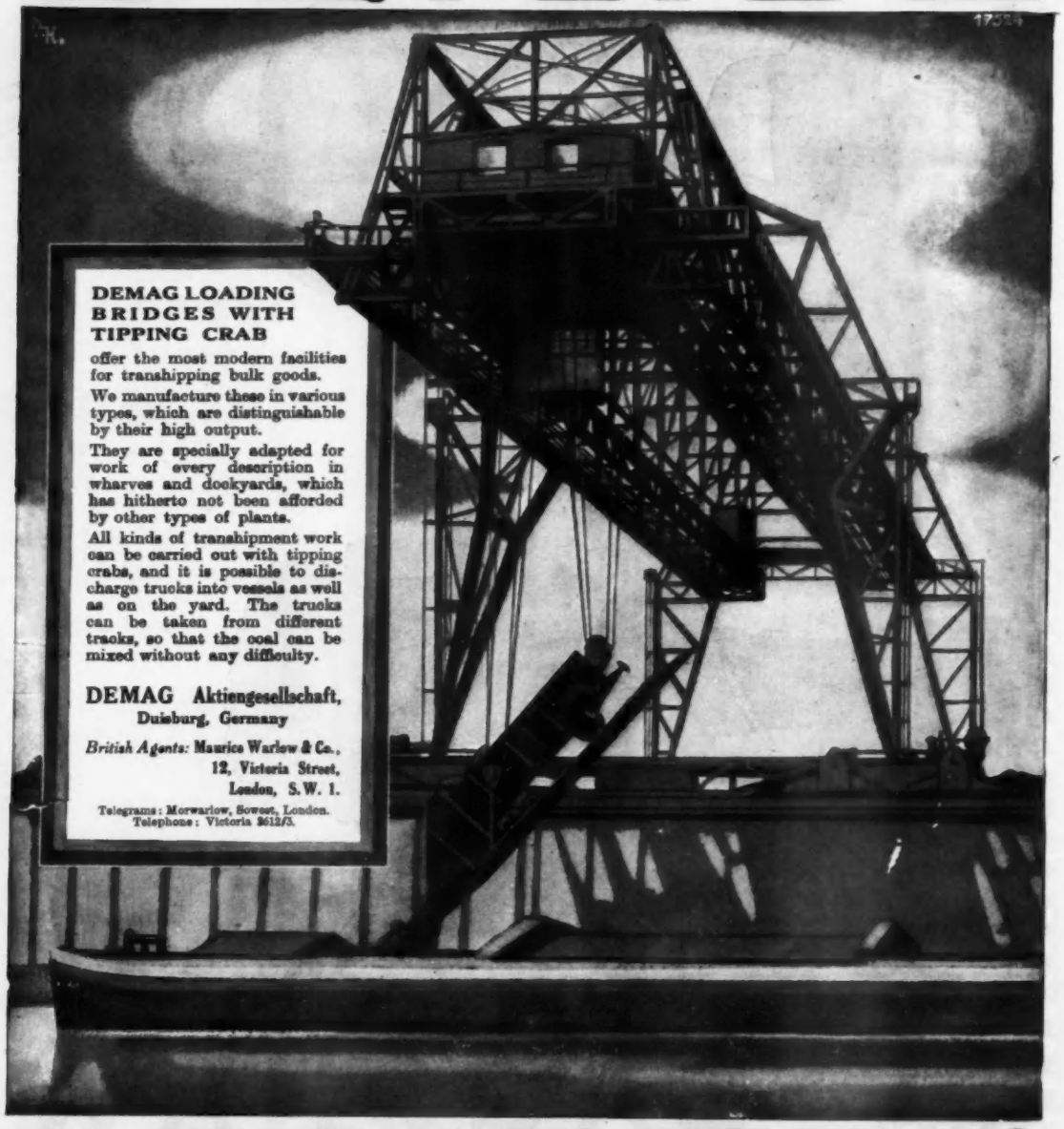
WELLINGTON MILLS WESTMINSTER BRIDGE RD., LONDON, S.E.1

CHARLES ROSS, LTD. SHEFFIELD,



FOR
WEIGHBRIDGES.
Any Size or Capacity, for Road or Rail.
PLATFORM WEIGHING MACHINES
for All Purposes.
YOUR ENQUIRIES ARE INVITED
London Office: 7, CARTARET ST., BROADWAY, WESTMINSTER, S.W.1.

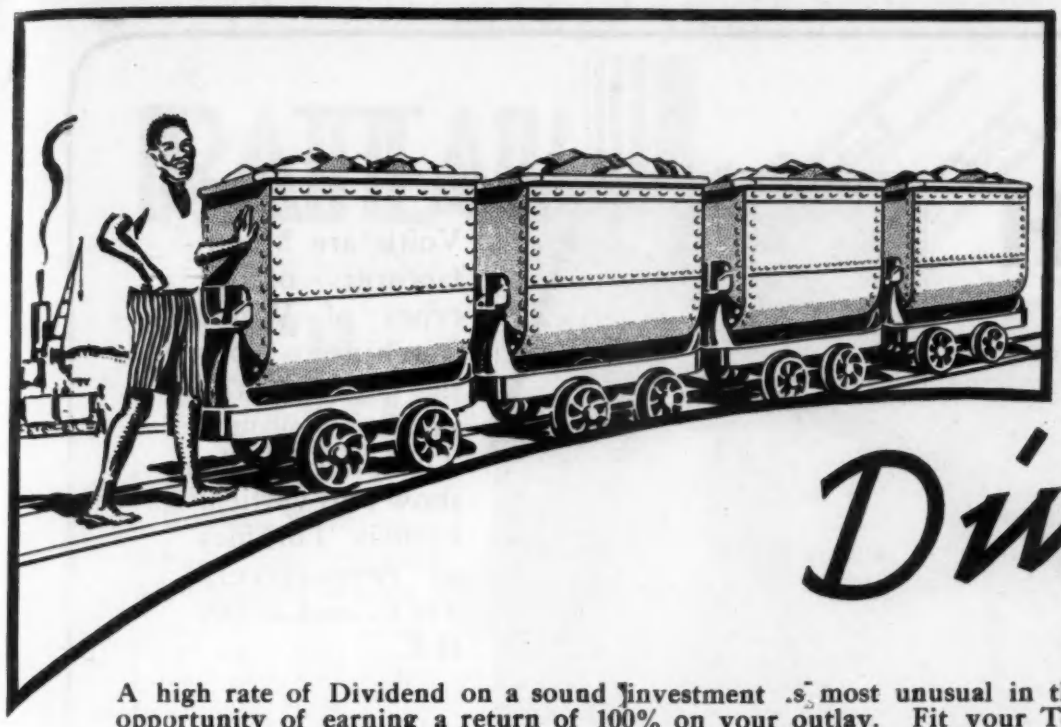
DEMAG



DEMAG LOADING BRIDGES WITH TIPPING CRAB
offer the most modern facilities for transhipping bulk goods.
We manufacture these in various types, which are distinguishable by their high output.
They are specially adapted for work of every description in wharves and dockyards, which has hitherto not been afforded by other types of plants.
All kinds of transhipment work can be carried out with tipping crabs, and it is possible to discharge trucks into vessels as well as on the yard. The trucks can be taken from different tracks, so that the coal can be mixed without any difficulty.

DEMAG Aktiengesellschaft,
Duisburg, Germany
British Agents: Maurice Warlow & Co.,
12, Victoria Street,
London, S.W. 1.
Telegrams: Morwarlow, Sowest, London.
Telephone: Victoria 3612/3.

DUISBURG



100% Dividend

A high rate of Dividend on a sound investment is most unusual in these days, yet here is *one* opportunity of earning a return of 100% on your outlay. Fit your Trucks with Hudson's Ball-bearing and Self-oiling Wheels and Axles instead of the ordinary type; they cost a little more, but the saving of grease and labour, together with increased efficiency and output and longer life, means to you a Dividend of 100% per annum on the extra cost.

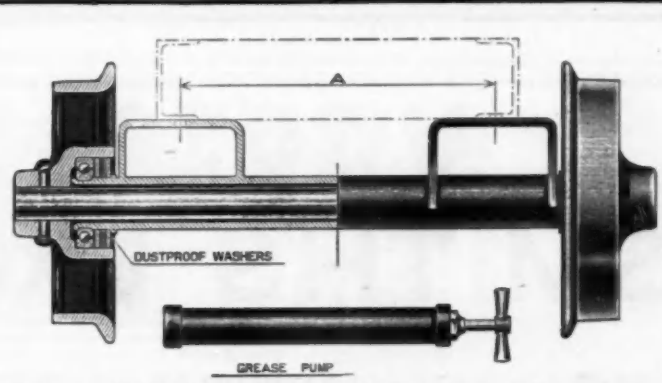
HUDSON'S PATENT
BALL BEARING WHEELS & AXLES
FOR MINING TRUCKS

YOU SAVE 85%
IN THE COST OF LUBRICANT

YOU SAVE 75%
IN STARTING EFFORT

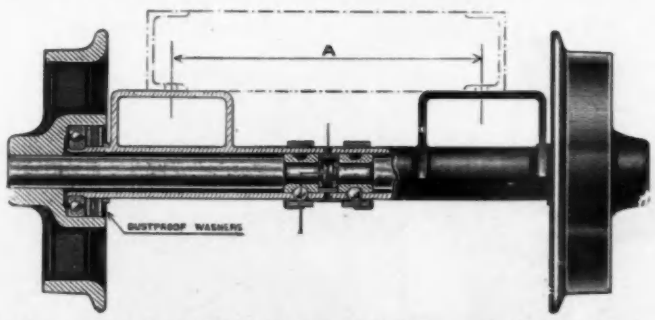
YOU SAVE 50%
IN HAULAGE POWER

The Enormous Saving in Grease and Labour means Economy, Long Life and Satisfactory Service



Patent "CABO" Type — Wheels fast on Axle.

THESE SETS WILL EARN A DIVIDEND OF 100% PER ANNUM ON THE EXTRA COST



Patent "BAKO" Type—Differential Motion.

THE PATENT GREASE-RETAINING SYSTEM NEEDS ATTENTION ONLY ONCE A YEAR, AND BEARINGS ARE ALWAYS LUBRICATED.

FITTED WITH HARDENED CHROME STEEL BALL OR ROLLER RACES.

The wheels are made of tough Cast Steel, the Axles and Sleeves of High Tensile Wrought Steel, and are ALMOST UNBREAKABLE.

WRITE FOR SPECIAL CATALOGUE. SAMPLE SETS ON APPROVAL TO LARGE USERS.

LONDON OFFICE:
Suffolk House,
Cannon St., E.C.4.
'Phone: Mansion House 7772.

EGYPT:
Cairo: P.O. Box 1446.

INDIA:
Calcutta: P.O. Box 23.
Karachi: P.O. Box 173.
Works: Kidderpore.

Robert Hudson
LIMITED
HEAD OFFICES: 38A BOND STREET, LEEDS

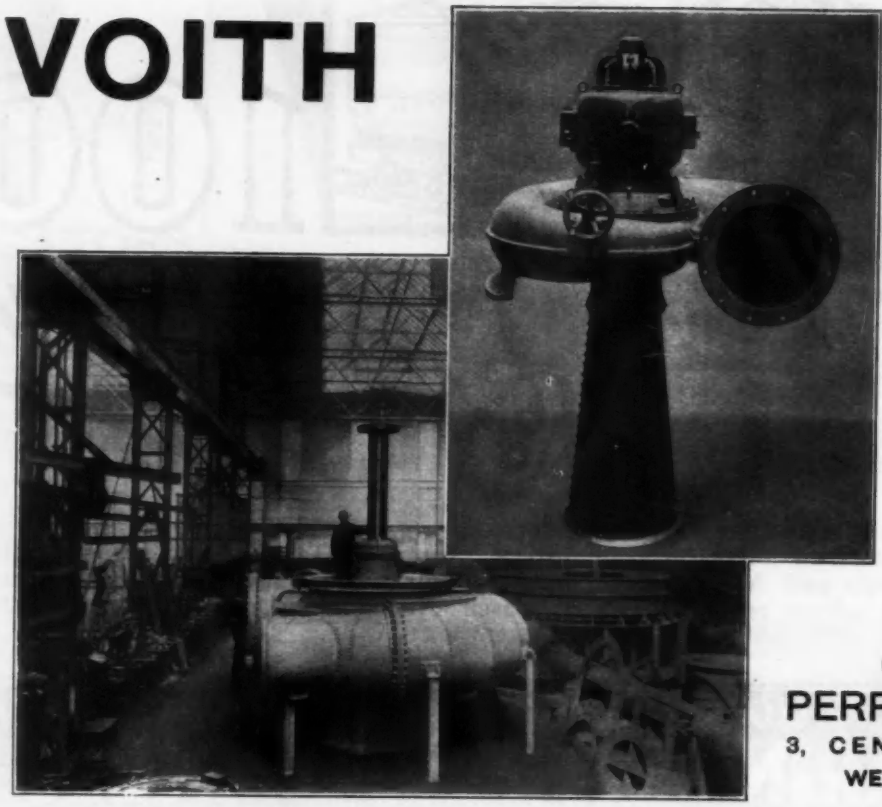
Telephones: Leeds 20004. Telegrams (all offices): "Raletrux." Codes: ABC (5th & 6th), Bentley & Marconi.

Works: GILDERSOME FOUNDRY, near LEEDS.

AFRICA:
Johannesburg: P.O. Box 5744.
Durban: P.O. Box 1007.
Durban Works:
Raletrux Ironworks.
Beira: P.O. 292.
Salisbury: P.O. Box 586.
Bulawayo: P.O. Box 322.
Loanda: P.O. Box 265.
Lobito: P.O. Box 101.

MAURITIUS:
P.O. Box 161, Port Louis.

VOITH



Voith are Manufacturers of all types of Water Turbines, from the largest to the smallest outputs. The photographs show two vertical Francis Turbines of respectively 5 H.P. and 26,000 H.P.

LONDON OFFICE:
PERRINS LIMITED,
3, CENTRAL BUILDINGS,
WESTMINSTER, S.W.1.

SMITH'S EXCAVATORS

Fitted with Navvy Shovel Attachment at work on the New Fish Dock at Grimsby and supplied to the Contractors, Sir Lindsay Parkinson & Co., Ltd., of Blackpool.

THOMAS SMITH & SONS (RODLEY) LTD., RODLEY, LEEDS.

A

RATEAU

Speciality 7

HIGH PRESSURE FANS .....

OVER 1,000 TYPES.
3,000 MACHINES IN STOCK.

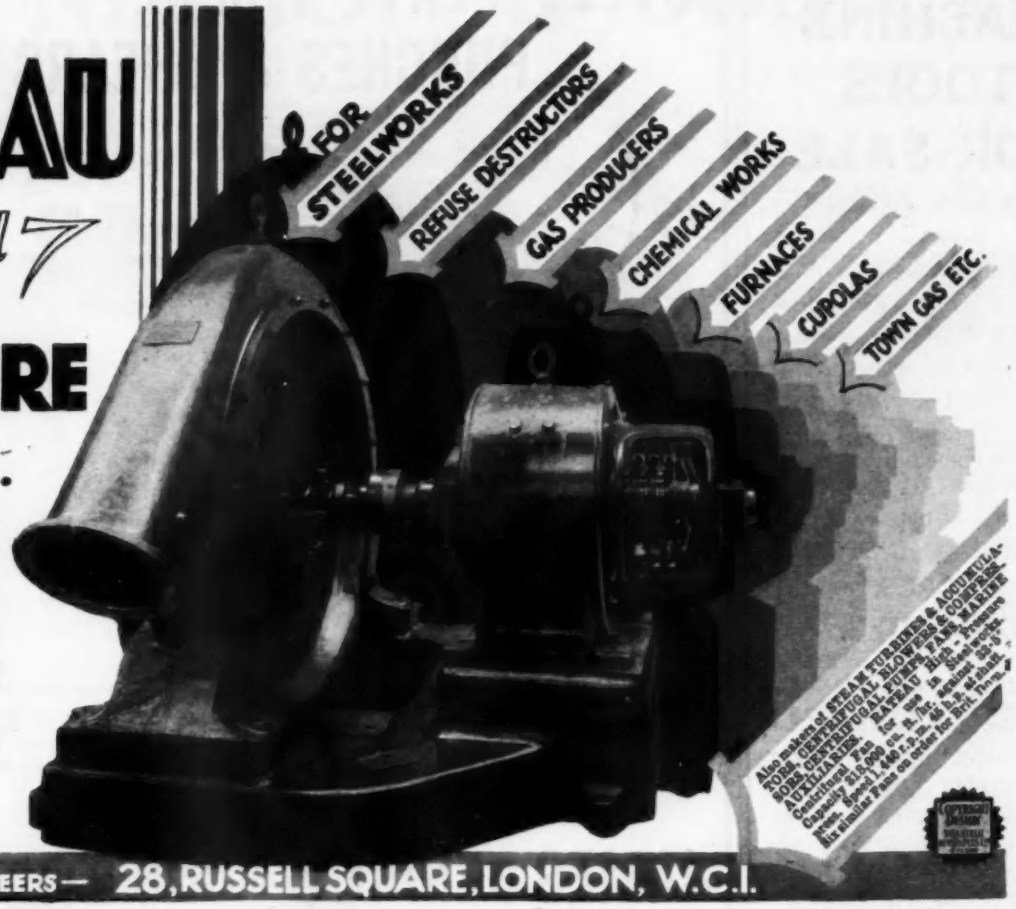
SOME STOCK SIZES.

Impeller Dia. in Inches.	Quantity cu. ft. /min.	Press. Inches W.G.	Price with Coupling.
	A B	A B	
16	300-700	11-6	£14 5 0
20	530-1500	19-9	£19 10 0
24	850-2250	26-14	£30 0 0
28	1,300-3,800	35-21	£41 10 0
32	1,700-5,800	48-27	£50 10 0
36	2,700-7,100	57-36	£75 0 0
40	3,200-9,000	58-36	£91 0 0

Efficiency up to 82 per cent.

Special Terms to Re-sellers

For particulars apply :—


FOR
STEELWORKS
REFUSE DESTRUCTORS
GAS PRODUCERS
CHEMICAL WORKS
FURNACES
CUPOLAS
TOWN GAS ETC.
Also makers of STEAM TURBINES & ACCUMULATORS, CENTRIFUGAL BLOWERS & COMPRESSORS, CENTRIFUGAL PUMPS, FANS, MARINE AUXILIARIES.
Capacity 815,000 cu. ft./hr. against 55-0"
Centrifugal Fan for use in Steel works.
RATEAU High - Pressure Fans, Speed 1,440 r.p.m. dia. of shaft.
Six similar Fans on order for Brit. Firms.

RATEAU, ENGINEERS— 28, RUSSELL SQUARE, LONDON, W.C.I.

Telegrams : "RATEAULOND, PHONE, LONDON." HEAD OFFICE : 40, RUE DU COLISÉE, PARIS (8e). Phone : MUSEUM 6780.

Representatives wanted in Great Britain and Dominions.

HENRY BERRY

& CO., LIMITED, LEEDS.

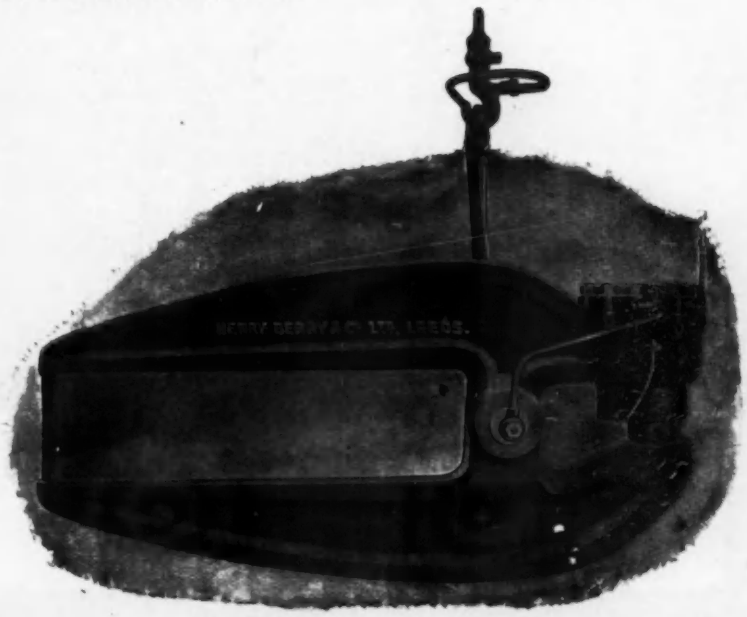
'Grams—Riveter, Leeds. *Telephone—20181 Leeds.*

IMPROVED HYDRAULIC RIVETING MACHINES

FOR BOILER WORKS, CONSTRUCTIONAL STEELWORKS, TANK MAKERS, SHIPYARDS, RAILWAY CARRIAGE AND WAGON SHOPS, &c. &c.

LONDON OFFICE—38, VICTORIA STREET, WESTMINSTER, S.W.1. *Tel.—3190 Vic., London.*

BEAR TYPE RIVETER.



HINGED TYPE RIVETER.

E

By Order of the Liquidators.

MACHINE TOOLS FOR SALE

MODERN DESIGN

Including :—

HERBERT Capstan Lathes
ASQUITH & FOSDICK Radial Drills
PRATT WHITNEY Grinding Machines
BROWN & SHARPE Milling Machines
GLEASON Gear Cutting Machines

AND ALL CLASSES OF MACHINE TOOLS, WORKS EQUIPMENT AND **WOODWORKING MACHINES**

AT THE

ARROL-JOHNSTON WORKS, DUMFRIES.

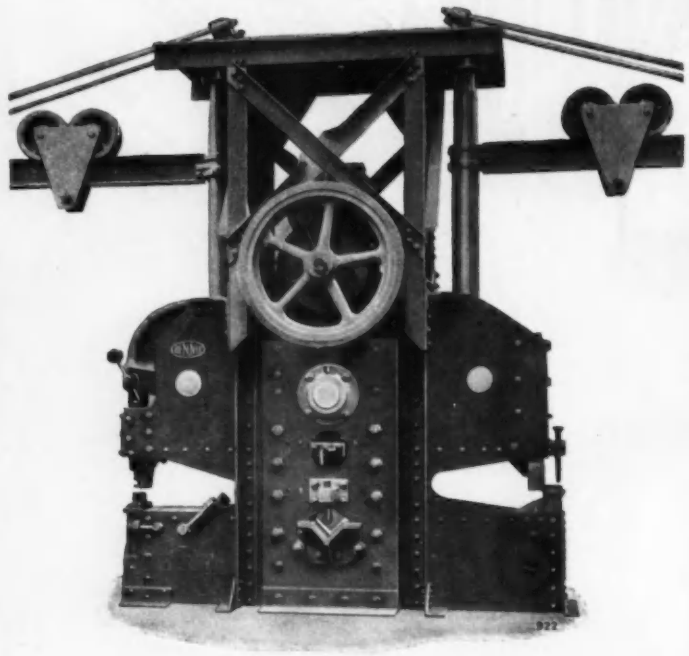
For Catalogues, etc., apply to:

ASTER LIMITED,
DERING HOUSE, DERING STREET, BOND STREET, LONDON, W.1.
Telephone: Mayfair 4131 & 4132.
Telegrams: "Asterenge, Phone, London.

OR

W. H. SUMNER,
SCOTTS ROAD, DEVONPORT ROAD, LONDON, W. 12.
Telephone: Shepherds Bush 2720.

STEEL PLATE FRAME PUNCHES & SHEARS



Punch, Shears and Angle Cropper with Two Cranes.

JAMES BENNIE & SONS LTD.

CLYDE ENGINE WORKS, GOVAN,

GLASGOW.

THE

"SOMERSET"

(HIGH SPEED)

AND THE

"CLYDESIDE"

(SLOW SPEED)

ROTARY PUMPS.

F.F. & L. Pulley Set.

These high speed and low speed Pumps are suitable for any duties where the liquid or semi-solid has to be transported. They are suitable for such extremes as water or petrol, light oils or heavy bitumens, and they can be applied to practically any problem involving the shifting of liquids or semi-solids.

See our Advt. last and next week.

Pumping Equipment Ltd.
555, Abbey House, Victoria St., Westminster, London, S.W. 1.
Victoria 2701.

Wright, Anderson & Co., Ltd.,

Constructional Engineers,

GATESHEAD-ON-TYNE.

LONDON OFFICE: 11, CARTERET ST., QUEEN ANNE'S GATE, S.W. 1.

TELEGRAMS: "CONSTRUCT, GATESHEAD."
TELEPHONE: GATESHEAD 72246.

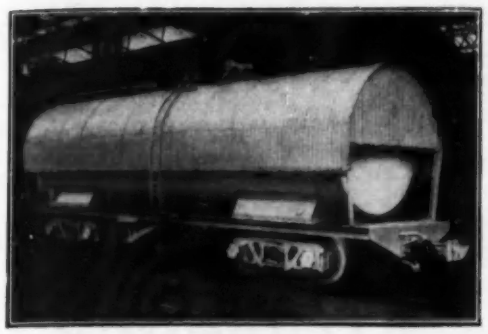
HURST, NELSON & CO., LTD.

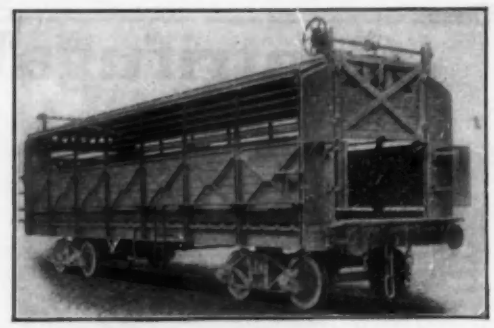
BUILDERS OF

RAILWAY CARRIAGES, WAGONS, ELECTRIC CARS AND EVERY OTHER DESCRIPTION OF RAILWAY AND TRAMWAY ROLLING STOCK.

MAKERS OF

WHEELS AND AXLES, RAILWAY PLANT, FORGINGS, SMITH WORK, IRON AND BRASS CASTINGS, PRESSED STEEL WORK OF ALL KINDS, INCLUDING UNDERFRAMES AND BOGIES.





London Office:

32, GREAT ST. HELEN'S, BISHOPSGATE, E.C. 3.

Glasgow Office:

78, ST. VINCENT STREET, C 2

Registered Office and Chief Works:

THE GLASGOW ROLLING STOCK & PLANT WORKS, MOTHERWELL.

HYDRAULIC FRAME PRESSES

INVERTED CYLINDER TYPE.

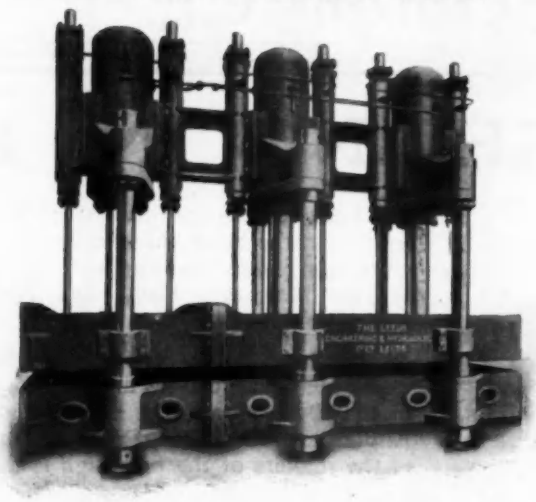


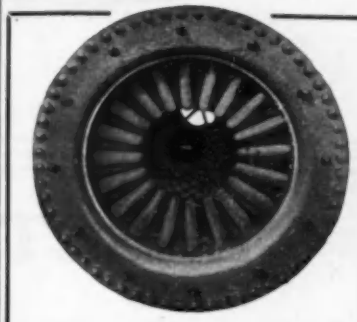
FIG. NO. 287—Total Power 400 tons, Table 19ft. 6ins. × 5ft. 0in.

The Leeds Engineering & Hydraulic Co., Ltd.

Telegrams & Cables: Pumps, Rodley. Code: A B C 5th Edition. Marconi International.

Works: RODLEY, near LEEDS.

Telephone: 71730 Stanningley.



CLARKSON

Silencer

BOILERS

for

WASTE HEAT RECOVERY from 2 or 4 STR. ENGINES.

SMALLEST WASTE HEAT BOILER

for

THE LARGEST WASTE HEAT RECOVERY.

Consult the Waste Heat Specialists

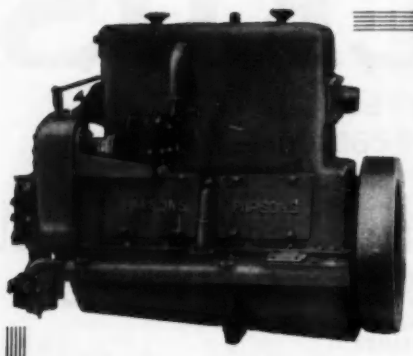
THE

Clarkson Thimble Tube Boiler

COMPANY, LIMITED,

613, AUSTRALIA HOUSE, STRAND, LONDON, W.C. 2.

Temple Bar 2112. Clarsteams, 'Phone, London.



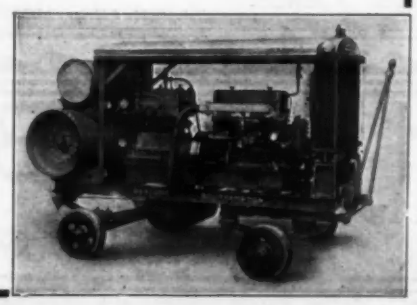
PARSONS

PORTABLE, SEMI-PORTABLE and STATIONARY PLANTS for ALL PURPOSES.

UNLIMITED PERIOD GUARANTEE.

Welding Sets.
Air Compressors.
Pumping Plants.
Electric Lighting Sets.
Fire-float Equipment.

London: Vic. 2525
Liverpool: Bank 1379
Newcastle: Cen. 2436
Glasgow: Cen. 6522



The Parsons Oil Engine CO., LTD.

SOUTHAMPTON (Eng.).

REDLER CONVEYING SYSTEM

Redler Patents, Sharpness, Glos., Eng.

COMPRESSED AIR PLANT

Air Compressors and complete Pneumatic Tool plant for all industries. Let us quote you.

165, QUEEN VICTORIA STREET, LONDON, E.C.4.

INGERSOLL-RAND Co., Ltd.

See the Mark?

The famous diamond trade mark which has made Jenkins and Valves synonymous terms throughout the world. Look for the mark when buying—it means valve efficiency for you.

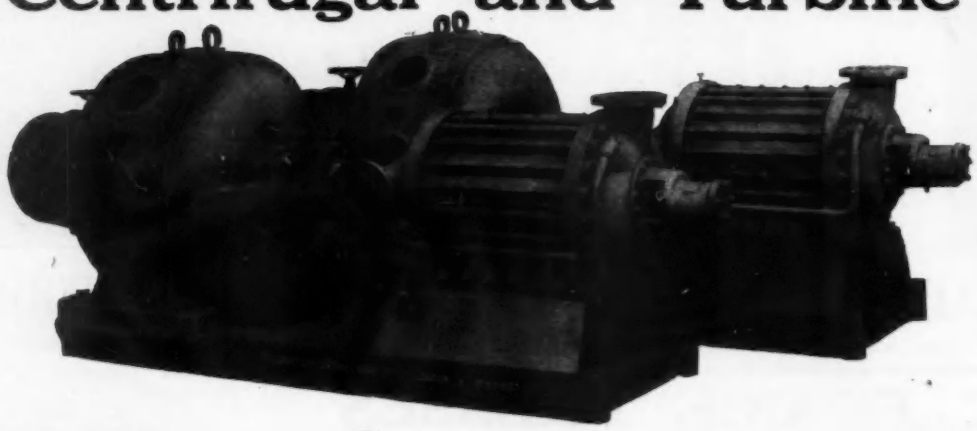
See our 90-page Catalogue post FREE.

JENKINS BROS. LTD. (Dept. K), 6, Gt. Queen Street, W.C. 2.

STONEBREAKERS
COMPLETE QUARRY AND
ROAD MAKING PLANT

H.R.MARSDEN LTD
LEEDS · ENGLAND

Centrifugal and Turbine Pumps



of the

Turbine Symbol

Highest Efficiency.

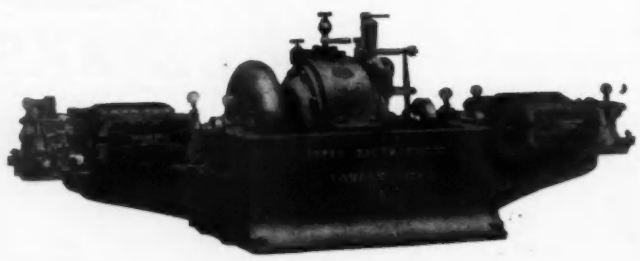
Write for List No. 771.

39, Victoria Street, London, S.W.1.

Pulsometer Engineering Co. Ltd

Nine Elms Ironworks, Reading.

ELECTRIC LIGHTING IN 1879.

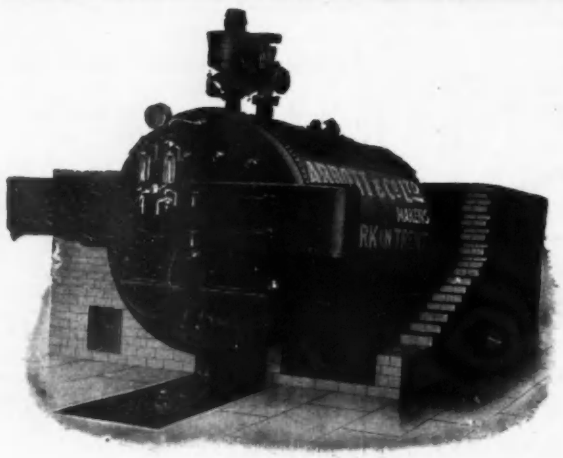


Long before the invention of the incandescent lamp, Brotherhood three cylinder engines, as here illustrated, were lighting with arc lamps the ships of Her Majesty's Navy, and running reliably at 1000 RPM.

Modern Brotherhood High Speed Generating Plant includes Steam Turbines working at speeds up to 10,000 RPM, and the Brotherhood-Ricardo Diesel Engine at 1000 RPM, so maintaining the traditions of the makers of the first high speed generating sets.

PETER BROTHERHOOD Ltd., PETERBOROUGH.

BRANCHES: LONDON, MANCHESTER, LEEDS and GLASGOW.



ABBOTT'S RETURN TUBE DRY BACK BOILER.
ECONOMICAL. EFFICIENT. LOW COST IN REPAIRS.

FOR
HIGH CLASS **BOILERS**
OF ALL TYPES
AND FOR ALL PRESSURES
apply to
ABBOTT & CO. (Newark) Ld., Newark-on-Trent

CONTRACTORS TO THE
ADMIRALTY,
WAR OFFICE,
INDIA OFFICE,
BOARD OF CUSTOMS,
CROWN AGENTS, &c.
&c.

FLANGED & WELDED WORK of every description.
MOTOR WAGON BOILERS,
HYDRO' CASINGS,
REPAIR FIRE-BOXES,
EVAPORATOR SHELLS,
VULCANISING PANS,
AIR RECEIVERS, &c.

Telegraphic Address: ABBOTT, NEWARK. A B C CODE (4th and 5th Editions) Telephone No. 34

FIRTH STAYBRITE STEEL

THOS. FIRTH & JOHN BROWN, LTD.
SHEFFIELD.

FIRTH STAINLESS
Registered Trade Mark.

FIRTH S+S TRADE MARK STAYBRITE

SEE OUR DISPLAYED ADVERTISEMENT ON PAGE 17.

Printing.—George Reveirs, Ltd., Greystoke-place, Fetter-lane, E.C., are PREPARED to SUBMIT ESTIMATES for all DESCRIPTIONS of PRINTING. "THE ENGINEER" has been printed at this establishment since its commencement.

PATENTS, DESIGNS AND TRADE MARKS.

Harris & Mills, Chartered Patent AGENTS, 34 and 35, High Holborn, London. Tel. Ad.: "Privilege," London. Tel. No.: Chancery 7765

BULL'S METAL & MELLOID CO., LTD. Yoker, Glasgow. Tel. Melloid, Yoker. Telephones: Scotstoun 2218 and 9.
BULL'S METAL.—Propellers, Bars, Sheets, Pump Rods, Valve Spindles, Condenser Stays and Plates, &c.
MELLOID (Reg. Trade Mark).—Condenser and Boiler Tubes, Stays and Plates, Bars, Sheets, Valves, &c.
HIGH TENSILE BRONZE.—Cast, Rolled, Forged, to Admiralty Requirements.
WHITE METALS.—Tempalto, Babbitt, Plastic, &c

THE CLASGOW RAILWAY ENGINEERING COMPANY LTD. GOVAN, GLASGOW.
London Office:—12, VICTORIA STREET, S.W.
MANUFACTURERS OF RAILWAY CARRIAGE, WAGON & TRAMWAY WHEELS & AXLES.
CARRIAGE AND WAGON IRONWORK, also CAST STEEL AXLE BOXES.

THE GLASGOW ROLLING STOCK & PLANT WORKS
HURST, NELSON & CO., LTD.,
BUILDERS OF RAILWAY CARRIAGES, WAGONS, ELECTRIC CARS, and every other description of RAILWAY and TRAMWAY ROLLING STOCK.
Makers of WHEELS, AXLES, RAILWAY PLANT, FORGINGS, SMITH WORK, and IRON and BRASS CASTINGS.
Registered Office and Chief Works; MOTHERWELL.
Cardiff Office: Merthyr House, Docks.
London Offices: 32, Great St. Helen's, Bishopsgate, E.C.3.
See illustrated Advt. page 31 this week.

P. & W. MACLELLAN LTD. CLUTHA WORKS, GLASGOW.
Manufacturers of RAILWAY WAGONS and CARRIAGES, IRON and STEEL SLEEPERS, FISHBOLTS, SPIKES, and other PERMANENT WAY MATERIAL, BRIDGES, and ROOFING.
CONTRACTORS for RAILWAY PLANT and STORES of every description.
Chief Offices: 120, Trongate, GLASGOW.
Registered Offices: Clutha House, 10, Princes Street, Westminster, London, S.W.1.

R. Y. PICKERING & CO., LTD. ESTD. 1864.
MANUFACTURERS OF
RAILWAY CARRIAGES, WAGONS, TANK WAGONS, TRAMCAR and 'BUS BODIES, WHEELS and AXLES, FORGINGS, MOUNTINGS and CASTINGS. For Home, Colonial and Foreign Railways.
WISHAW — SCOTLAND.
LONDON OFFICE:
10, Iddesleigh House, Caxton Street, S.W.1.

G. R. TURNER, LTD. Manufacturers of
RAILWAY ROLLING STOCK & MINING MACHINERY
For Home and Abroad.
Specialities:
Railway Wagons of every description. Tipplers
Colliery Screening Plants. Elevators & Conveyors
Steel Headgears and Rop Gears. Structural Steel Work
Haulage Gears. Forgings and Castings.
Chief Works & Office: LANGLEY MILL, nr. NOTTINGHAM
London Office: 32, Victoria Street, S.W.1.
(Illustrated Advt. first issue in each month on page 8.)

GLOUCESTER FOUNDRY LTD.,
Wrought Iron Pulley Makers.
Malleable Iron & Non-Ferrous Castings of every description.
'Phone: 3041. Telegrams: "Pulleys," Gloucester.
EMLYN WORKS, GLOUCESTER.

SUPERHEATERS
LOCOMOTIVE MARINE STATIONARY
SWANSEA SUPERHEATERS LTD.
SWANSEA.

BRICK MAKING MACHINERY
Herbert Alexander & Co. Ltd.
Charmouth St.
LEEDS.

IRON PLATE WORK, TANKS, &c., GALVANIZING.
Send your enquiries to:
ARKINSTALL BROS. Ltd.,
COVENTRY STREET, BIRMINGHAM, Eng.

STEAM OR COMPRESSED AIR
HAM- -MERS
FROM 10 CWTS. TO 40 CWTS.
A BARCLAY SONS & Co LTD KILMARNOCK

HIGH SPEED STEAM ENGINES
OF THE
VERY HIGHEST CLASS.
ASHWORTH & PARKER,
BURY, LANCS.
See advertisement June 5th.

GEORGE RUSSELL & Co. LTD., MOTHERWELL.
ENGINEERS AND BUILDERS OF **CRANES** OF ALL TYPES AND SIZES.

LEDWARD & BECKETT, LTD.
PARLIAMENT MANSIONS, VICTORIA ST., WESTMINSTER, S.W. 1.
(Opposite Post Office).
Makers of **EJECTOR CONDENSERS**
for TURBINES or RECIPROCATING ENGINES,
AUTO. VALVES, VACUUM BREAKERS, ETC.
Catalogues on application.
New Telephone Number: Victoria 3415. Telegraphic Address: Preferment, Sowest, London

centrifugal PUMPS
OF SPECIAL DESIGN
for
dealing
with
PETROL
SUGAR
PAINT
SOAP
WINE
and other special liquors
Write for List E 26
HOLDEN & BROOKE LTD SIRIUS WORKS WEST GORTON MANCHESTER
London Office: 562/4 Abbey House Westminster SW 1
HOLDEN & BROOKE

WAYGOOD-OTIS LIFTS *MADE IN LONDON.*
Head Offices: 54-55, Fetter Lane, London, E.C. 4. (Tel. Central 9141).
Factory: Falmouth Road, S.E. 1.
Branches in Principal Provincial Centres and Abroad.

Modern Boiler Practice for Maximum Economy utilises PRE-HEATED AIR in addition to HOT FEED WATER.
The only Fuel Economiser to provide both these essentials is the
GALLOWAYS' **SUPERMISER** LEEK PATENTS
Full particulars on request.

GALLOWAYS LIMITED
KNOTT MILL, MANCHESTER.

"I can testify to its efficiency."—LORD KELVIN.
Boyle's PATENT "AIR-PUMP" VENTILATOR
NOTICE!
Office and Works will be Closed from 1st August to 10th August inclusive, for annual holidays.
ROBERT BOYLE & SON
VENTILATING ENGINEERS,
65, HOLBORN VIADUCT, LONDON.
Telephone: CENTRAL 4583.

JOHN SPENCER LTD WEDNESBURY.
IRON AND STEEL **TUBES**
POLES, STEAM MAINS, TUBULAR PILES &c

W. H. ALLEN, SONS & Co.
LIMITED,
QUEEN'S ENGINEERING WORKS,
BEDFORD, ENGLAND.

J. & E. HALL LIMITED
ENGINEERS
DARTFORD, KENT.
London Office: 10, ST. SWITHIN'S LANE, E.C. 4.
Tel.: Dartford 201; Mansion House 7356.
REFRIGERATION *for both* **LAND** *and* **MARINE PURPOSES**
Established 1785.

GIBBONS BROS., Ltd., DUDLEY
Telegs.—Gibbons, Lower Gornal. Telephone—10 Dudley
Contractors to ADMIRALTY and WAR OFFICE
PATENTEES & BUILDERS OF
Regenerative Muffles & Furnaces
FOR ALL ENGINEERING WORK.

GLENIFFER MARINE MOTORS
See Illustrated Advertisement last and next week
GLENIFFER ENGINES LTD.,
Anniesland, GLASGOW.

HILL & SMITH LTD
CONSTRUCTIONAL ENGINEERS
BRIERLEY HILL STAFFS

HAMWORTHY
OIL ENGINES
PUMPS & AIR COMPRESSORS.
THE HAMWORTHY ENGINEERING CO., Ltd., Poole, Dorset.
Branches { 76, Victoria Street, LONDON. 118, Queen Street, GLASGOW.

'SAIRSET
HIGH TEMPERATURE CEMENT
STEAM PLANT ACCESSORIES LTD.
38 VICTORIA STREET,
Phone: VICT. 6053. LONDON, S.W.1

USE FOR BONDING FIREBRICK, AS IT MAKES THE JOINT STRONGER THAN THE BRICK.
AIR SETS AND REMAINS SET. WITHSTANDS HIGH TEMPERATURES.

HERE is an example of Vertical Cover in CELLACTITE, erected for The Britannia Lead Co., Northfleet. No rusting, no painting, no cracking, no danger — upkeep cost abolished — permanent protection at last.
STEEL-STRONG CELLACTITE needs a minimum of sub-structure. It is a fine insulator, keeping buildings warm in winter and cool in summer. It resists chemical fumes and sea air. It prevents condensation and drip.
Please write for a detailed Catalogue for your files.
CELLACTITE & BRITISH URALITE LTD.
196-302, High Holborn, London, W.C.1.
CELLACTITE
FOR ROOFS & VERTICAL COVER
1
2
3

TAS/Cel. 40a

THE

USCO SLUICE TYPE ASH CONVEYOR

The USCO Sluice Type Ash Conveyor is adaptable to any boiler house, and is especially suited to an irregular layout of boilers. Curves and bends present no difficulties. The conveyor itself has no moving parts. Maintenance charges are therefore reduced to minimum.

Write to-day for a copy of our latest catalogue: USCO Ash and Clinker Handling Equipment for Gas, Power and Industrial Plants.

USCO Sluice type Ash Conveyor installed in a London Power Station (note the curves).

UNDERFEED STOKER CO. LTD.

ALDWYCH HOUSE, ALDWYCH, LONDON, W.C. 2.

Telephone: Holborn 2002. WORKS: DERBY. Telegrams: "Underfeed, Estrand, London."

BRIDGES.

BRIDGE CARRYING LONDON MIDLAND & SCOTTISH RAILWAY OVER RIVER RIBBLE.

SIR WILLIAM ARROL & Co. LTD. GLASGOW.

COPES

BOILER FEED REGULATORS

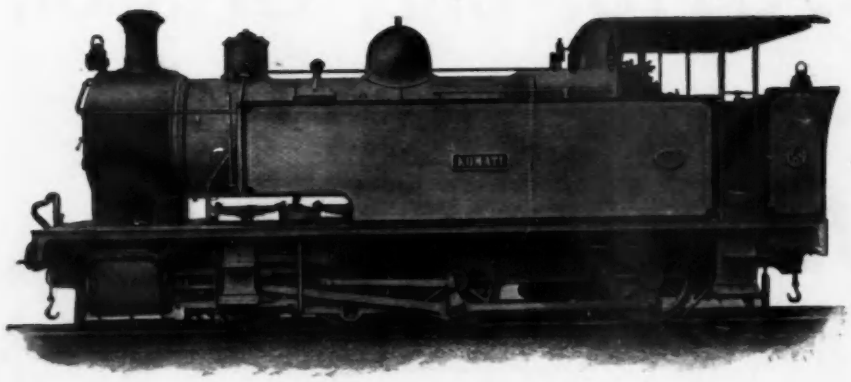
INEVITABLE for CORRECT CONTROL

WRITE TO THE SPECIALISTS—
COPES REGULATORS LTD.,
231, STRAND, LONDON, W.C. 2.

ESTABLISHED 1860.

HUDSWELL, CLARKE & CO., LIMITED.

RAILWAY FOUNDRY, LEEDS.



LOCOMOTIVES

FOR MAIN OR BRANCH RAILWAYS,

Docks, Contractors, Steelworks, Collieries, &c.
All sizes and to suit any Gauge of Railway.

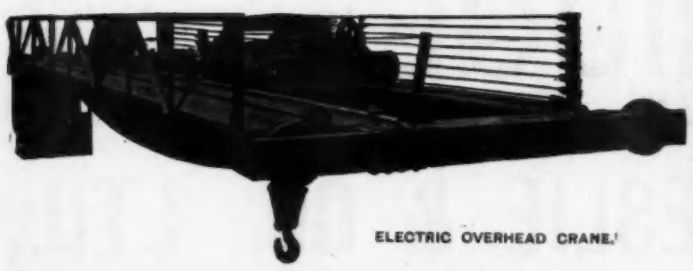
Makers of

All Types of Diesel Locomotives.

Prices, Photographs and full specifications on application.

Telegrams—Loco, Leeds. Telephone—National 20993.
Codes—A1, Lieber's, A B C (4th and 5th Editions).

London Office: **Liley, Pearson & Co., 39, Victoria Street, Westminster, S.W.1.**



ELECTRIC OVERHEAD CRANE.

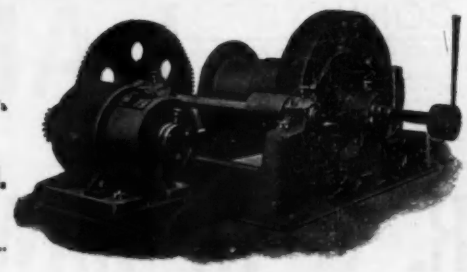
CRANES

OF EVERY DESCRIPTION.

Write for Catalogues.

JOHN SMITH (KEIGHLEY) LTD.
Crane Works, KEIGHLEY.

Inland Telegrams: "CRANES, 'PHONE, KEIGHLEY."
Foreign Telegrams: "CRANES, KEIGHLEY."
Telephone 2229.



ELECTRIC FRICTION WINCH.

STEAM TRAPS

Of unrivalled capacity—quick discharge—positive mechanical action—will do the work of three ordinary traps.

SENT ON TRIAL.

THE UNITED STATES METALLIC PACKING CO., Ltd., Soho Works, Allerton Rd., BRADFORD.

Telegrams: "METALLIC." Branch Offices: Telephone: Nos. 4705, 4706.
LONDON: 116, Fenchurch St. LIVERPOOL: 632, Royal Liver Bldgs. BOLTON: Knowsley Bldgs. SWANSEA: Pembroke Bldgs. GLASGOW: 52, St. Enoch Sq. NEWCASTLE: 2, Collingwood St., &c. &c.

Horizontal Boring Facing, Milling and Screw-cutting Machines

Established HARVEY 1855

A REVOLUTION IN DESIGN
A REVELATION IN PERFORMANCE.

Positive Worm Drive.

No loss due to slip of belts.

Forced Lubrication in Saddle, Driving and Feed Gear.

Gate Change Control Quick Traverse in all directions, including slide on faceplate.

Suitable for single belt or constant speed motor drive.

G. & A. HARVEY LTD., Albion Works, GOVAN, GLASGOW, S.W.1

TELEGRAMS: GANDAH GLASGOW.

PECKETT & SONS, Ltd., Bristol.

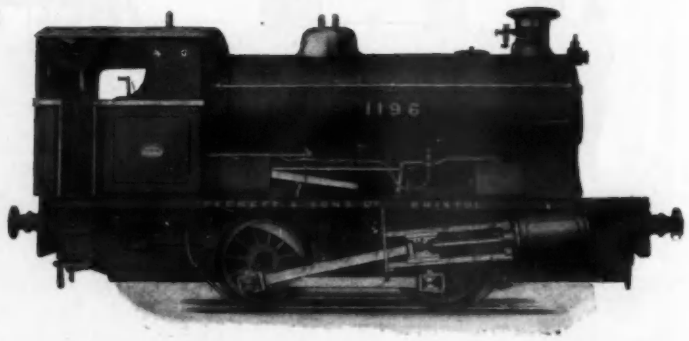
Telegrams—PECKETT, BRISTOL. London Representatives: FERGUSON & PALMER, 9, Victoria Street, Westminster, S.W. 1.

Speciality

TANK LOCOMOTIVES

of all Descriptions, and any Size or Gauge.

FULL PARTICULARS ON APPLICATION.



CONVEYORS
CRANES - RUNWAYS, ETC.
General Engineering Work. Highest Class Iron & Brass Castings. Modern Machine & Erecting Shops, Sheet Metal, Woodworking, Smithy, etc.

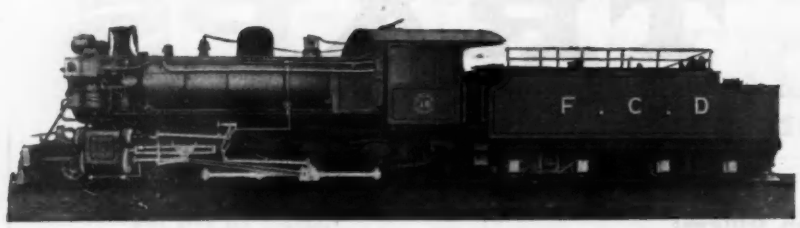
LANG BRIDGE LTD.

Telegrams: Bridge Accrington. ACCRINGTON Telephone: Accrington 2131.

ELEVATORS
Makers of The Most Efficient Machinery for The Bleaching, Dyeing, Finishing and Printing of Calico and Silk. Fireproof Doors and Fire Extinguishers. Drying Cylinders—Tin & Copper.

R. & W. HAWTHORN, LESLIE & CO., LTD.,

London Office: 54, Victoria Street, Westminster, S.W. 1. NEWCASTLE-ON-TYNE.



LOCOMOTIVES

Of every description for Home and Foreign Railways.

TANK ENGINES AND COMBINED CRANE AND LOCOMOTIVES

Always in Stock and in Progress.

FOR COLLIERIES, IRONWORKS, RAILWAY DEPOTS, BRANCH LINES, CONTRACTORS.

Marine Engineers and Shipbuilders.

Teleg. Add.—LOCOMOTIVE, NEWCASTLE-ON-TYNE. ESTABLISHED 1817.

Checkmate the rust enemy now!

BRIGGS' ANTI-CORROSIVE SOLUTIONS definitely counter the ruinous action of corrosion on structural iron and steel work of every description.

They are applied like ordinary paints, compare favourably in price, and their large covering capacity and superior lasting powers bring additional economy.

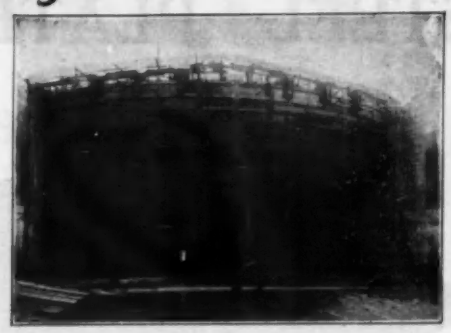
Colours: Black, Red, Grey and Green.

Ask for a free testing sample.

BRIGGS'
BITUMINOUS SOLUTIONS

WILLIAM BRIGGS & SONS, LTD., DUNDEE.

London Office: 6, Lloyd's Avenue, E.C.3. Telephone: Royal 8679.



Port of London Authority Dock Gates are BRIGGS PROTECTED.

ŠKODA WORKS LTD

PRAGUE :: CZECHOSLOVAKIA.

A representative group of complex thin-walled castings of electrically smelted steel.

SKODA ELECTRIC STEEL CASTINGS

ensure

homogeneity and non-porosity and eliminate abortive machining costs.

Agents in United Kingdom—

CARTERS (MERCHANTS), LTD.,

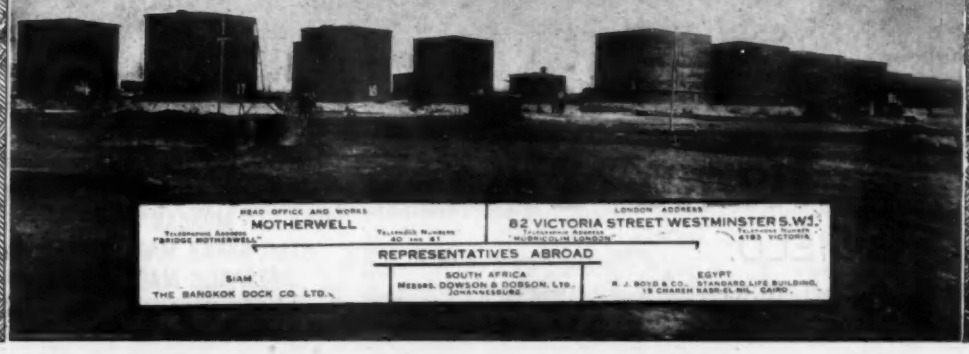
Telephones: London Wall 7601 & 7608.

Friars House, 39-41, New Broad St., LONDON, E.C. 2.

Telegrams: "Adfuturum, Ave, London."

STRUCTURAL STEEL AND IRON-WORK OF EVERY DESCRIPTION. BRIDGES, ROOFS, STEEL FRAMED BUILDINGS, CRANE GIRDERS, CRANE GANTRIES, CHIMNEYS, PIT HEAD FRAMES, TOWERS, RIVETTED PIPES.

THE MOTHERWELL BRIDGE AND ENGINEERING CO., LTD.



HEAD OFFICE AND WORKS: MOTHERWELL — LONDON ADDRESS: 82 VICTORIA STREET WESTMINSTER S.W.1.

REPRESENTATIVES ABROAD

SIAM: THE BANGKOK DOCK CO. LTD.

SOUTH AFRICA: Messrs. DOWSON & DOBSON, LTD., JOHANNESBURG.

EGYPT: A. J. BOYD & CO., STANDARD LIFE BUILDING, 19 CHAREH NASR-EL-NIL, CAIRO.

KILNS AND TUBING, PIERS, JETTIES, PONTOONS, DOCK GATES, CAISSONS, OIL STORAGE TANKS, WATER TANKS, PRESSED STEEL TROUGHING, SLEEPERS, GUTTERS, ETC.

STEEL PLATE GROUND MANHOLE COVERS.

Made of UNBREAKABLE Steel Chequer Plate, making a safe load for 5, 10 or 15 tons.

Very Light. ... Easily Handled.
Low Freight Cost for Transit Abroad.

STOCK SIZES–

30 × 30 24 × 24 24 × 18 18 × 18

Other sizes may be made.

For every place where a Manhole Cover is Wanted.
Cannot be Broken by Lorries or by Rough Treatment.

SEND FOR FOLDER giving full particulars of measurements, weights, and CONSIDERABLY REDUCED PRICES.

London Office:
354, Abbey House,
Victoria Street, S.W. 1.
Telephone:
Victoria 6783.

Robert Jenkins & Co. Ltd.
IVANHOE WORKS
ESTD. 1856 ROTHERHAM

Telegrams:
"Jenkins, Rotherham."
Telephone:
584 (3 lines).

"DAVY" HIGH-SPEED FORGING PRESSES

These presses are built in sizes from 100 to 12,000 tons power and are fitted with special patent devices to ensure:

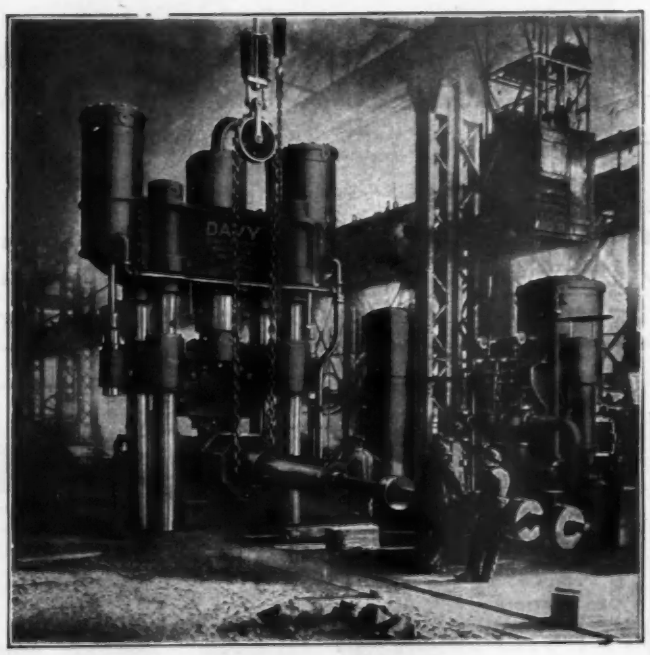
GREATEST POSSIBLE SPEED OF WORKING.
MINIMUM STEAM CONSUMPTION.
EASE AND SAFETY IN WORKING.

By means of our PATENT STEAM SAVING DEVICES the steam consumption is automatically adjusted to the work resistance of the press, thus ensuring the utmost possible economy.

The above results are realised with the minimum of complication and are not dependent on skilful operation.

The outstanding position of the "Davy" Press is shown by the number of orders received from the leading makers of forgings all over the world. We have built 170 presses totalling 243,000 tons power, and 180 presses totalling 157,000 tons power have been supplied by our licensees to the principal works in the U.S.A.

Catalogue and quotations submitted on request.



2000 Tons High-Speed Forging Press.

DAVY BROTHERS LTD.,

SHEFFIELD.

Established 1830.

Telephone:
Sheffield 22161 (5 lines).

Telegrams:
Motor, Sheffield.

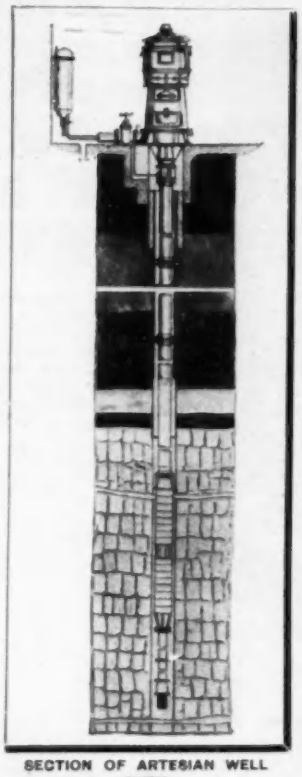
We are also makers of :—

HIGH-SPEED FORGING PRESSES,
MODERN ROLLING MILL PLANT, INCLUDING
"MORGAN" CONTINUOUS MILLS,
STEELWORKS MACHINERY, STEAM HAMMERS,
HYDRAULIC MACHINERY, STEAM BOILERS.
"FIRTH STAYBRITE" TANKS AND VESSELS.

ARTESIAN WELLS

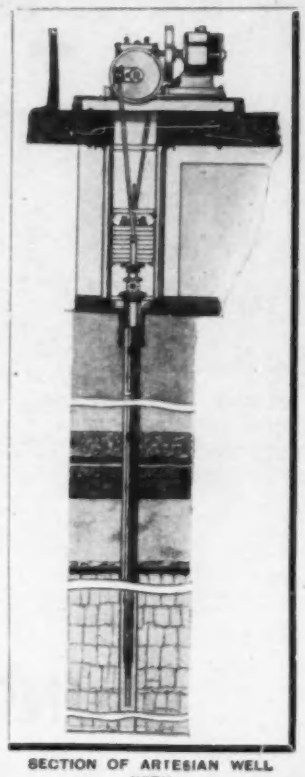
FOR

INDEPENDENT WATER SUPPLY



SECTION OF ARTESIAN WELL WITH BOREHOLE TURBINE PUMP.

OVERFLOWING WELL.



SECTION OF ARTESIAN WELL WITH DEEP WELL PUMP.

C. ISLER & CO., LTD.

ARTESIAN WORKS, BEAR LANE, SOUTHWARK, LONDON, S.E.1

BIRMINGHAM: 93, Broad Street. Telephone: HOP 4460. Telegrams: ISLER, LONDON. LEEDS: Bardon Chambers, King Street.

PUMPING MACHINERY

OF ALL KINDS

FOR

MINES, WATERWORKS, SEWAGE, IRRIGATION,

ETC. ETC.

STEAM, ELECTRICALLY OIL OR BELT DRIVEN.

TRANSPORTING PUMPING MACHINERY FROM OUR WORKS TO SITE OF LONDON'S WATER SUPPLY AT DEPTFORD.

(LOOK OUT FOR PHOTOGRAPH OF THIS MAGNIFICENT PLANT IN FUTURE ISSUES OF THIS PAPER.)

HATHORN DAVEY & Co., LTD., LEEDS.

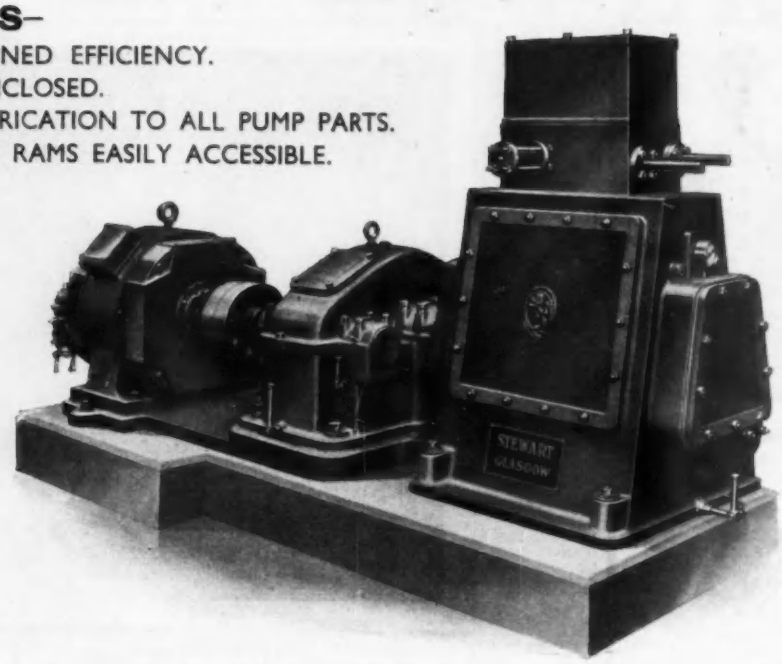
TELEPHONE: 22491. TELEGRAMS: HATHORN, LEEDS.

VERTICAL HIGH SPEED TRIPLE RAM PUMP

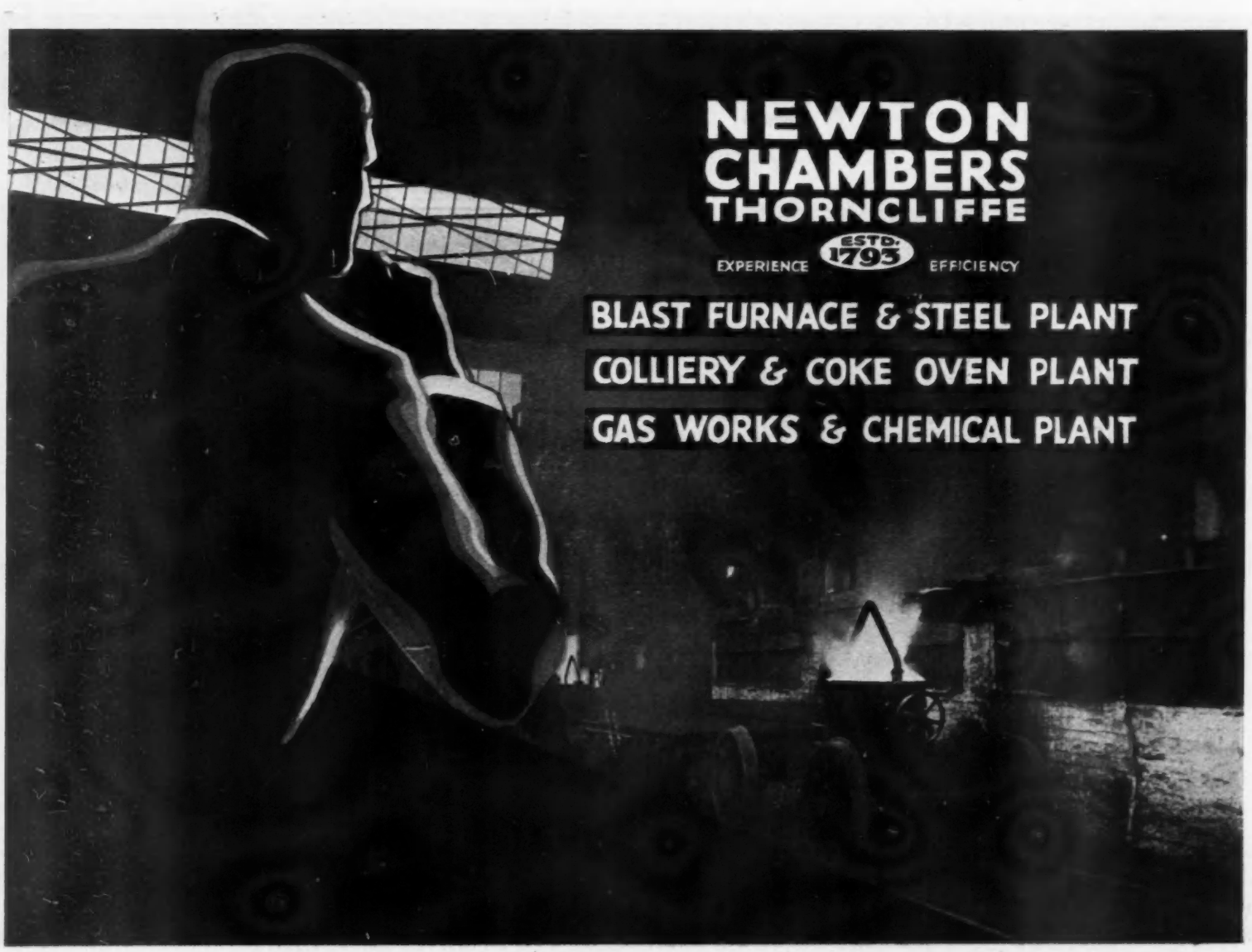
SPECIAL FEATURES–

HIGH COMBINED EFFICIENCY.
TOTALLY ENCLOSED.
FORCED LUBRICATION TO ALL PUMP PARTS.
VALVES AND RAMS EASILY ACCESSIBLE.

This pump on test had a volumetric efficiency of 96·5% at 4000 lbs. pressure per sq. inch.



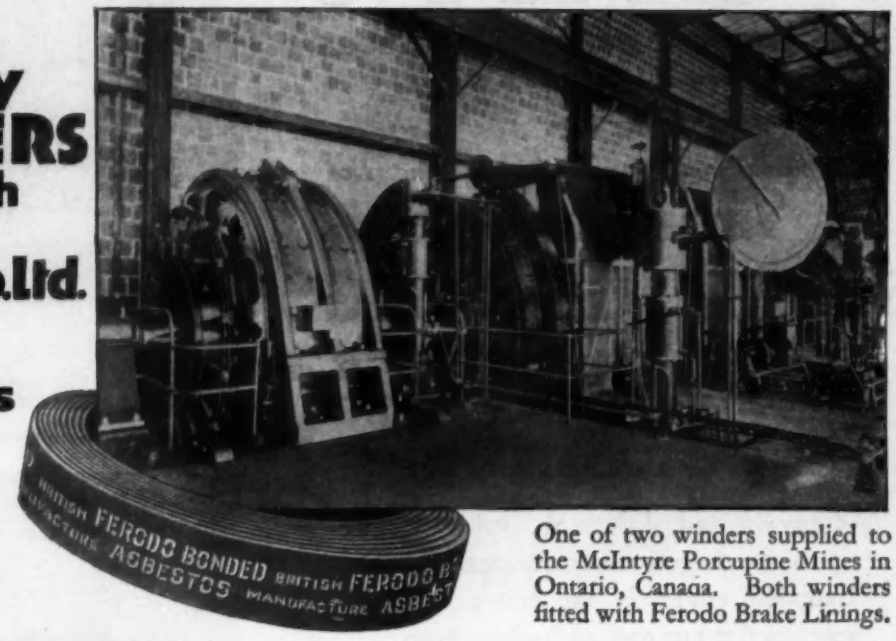
DUNCAN STEWART & CO., LTD.,
LONDON ROAD IRONWORKS,
GLASGOW.



This 1400 h.p Electric Winder by FRASER & CHALMERS Engineering Works—Erith (Proprietors— The General Electric Co. Ltd. is fitted with FERODO Brake Linings

Whenever important machinery is to be installed, the inclusion of Ferodo Linings in the specification ensures positive brake and clutch efficiency. Manufacturers and Purchasing Engineers know from experience that these linings are dependable under the most strenuous working conditions. The tough Ferodo fabric forms the most durable friction lining in existence.

A copy of our new booklet dealing with Linings for the Mining and Engineering trades will be gladly forwarded on request.



One of two winders supplied to the McIntyre Porcupine Mines in Ontario, Canada. Both winders fitted with Ferodo Brake Linings.

FERODO
BRAKE & CLUTCH LININGS

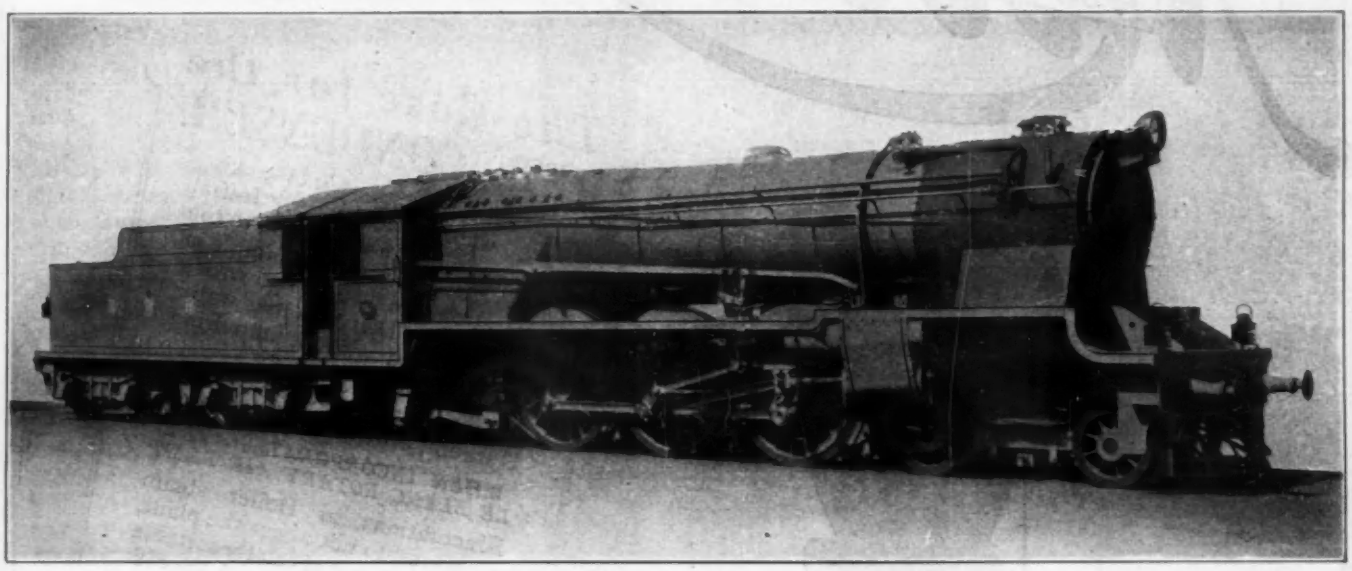
3/88

FERODO LIMITED • CHAPEL-EN-LE-FRITH

NORTH BRITISH LOCOMOTIVE Co., LTD., GLASGOW.

BUILDERS OF ALL TYPES OF

LOCOMOTIVES



4-6-2 TYPE

FOUR CYLINDER "DE GLEHN" COMPOUND LOCOMOTIVE FOR THE 5′ 6″ GAUGE

BENGAL NAGPUR RAILWAY (SIR JOHN WOLFE BARRY & PARTNERS, CONSULTING ENGINEERS)

Cylinders {2 H.P. 16½″ × 26″ / 2 L.P. 25″ × 26″
Coupled Wheels 6′-2″
Heating Surface 3076 sq. ft.
Grate Area 51 „ „
Total Weight (E & T) — 171 tons.
Tank 4750 gals.
Fuel 450 cub. ft.

GHH

GUTEHOFFNUNGSHUTTE DÜSSELDORF
(Vorm. HANIEL & LUEG).

For more than 50 years Manufacturers of

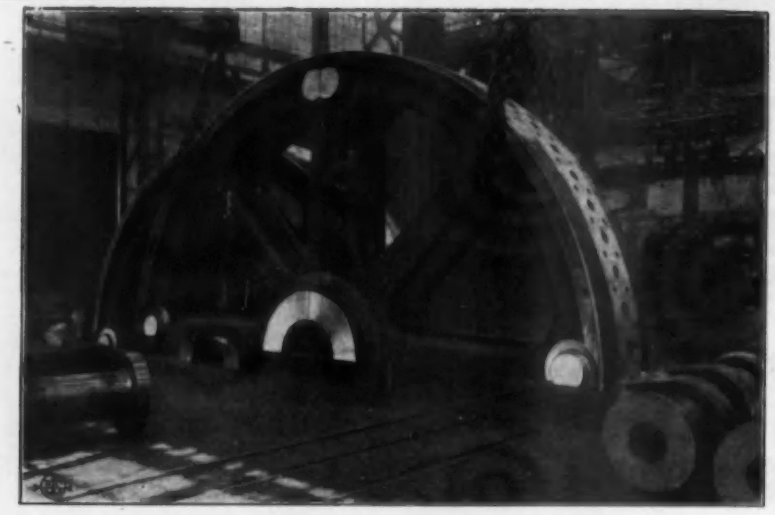
HIGH GRADE
STEEL CASTINGS
IRON CASTINGS
FORGINGS

of any size and of the most intricate nature up to the largest dimensions and weights. Supplied either in the rough or finish machined in our own up-to-date shops.

FOR ENGINEERING, SHIPBUILDING and MINING.
FOR THE CHEMICAL AND OTHER INDUSTRIES.

British Representatives:

BROWN & PARTNERS, LTD.,
19, St. Vincent Place, GLASGOW.
Telephone No.—9946 CENTRAL. Telegrams—"BRUNERICAN."
and Adelaide House, King William Street, LONDON, E.C. 4.
Telephone No.—Mansion House 5307. Telegrams—Brunerican, Canon, London.

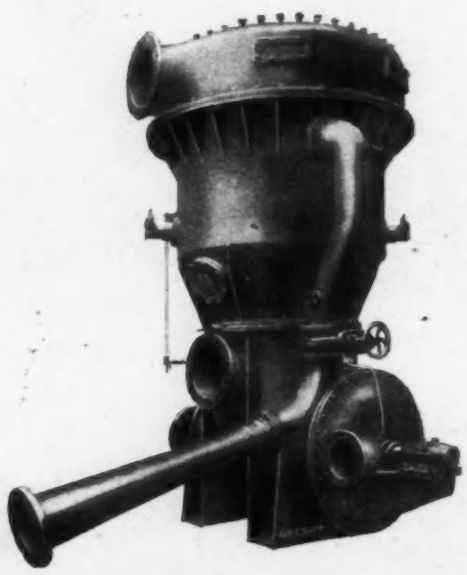


Alternator Rotor in Four Sections. Total Weight 100 tons.

Eight-throw Crank Shaft for large Diesel Engine.

'Mirrlees'

FROM TURBO EXHAUST TO BOILER



The Case for the JET CONDENSER.

A minimum amount of cooling water is necessary. Initial cost is low in relation to the high efficiency given. Simple in operation and little to go wrong internally. Dirty cooling water may be used without impairing the efficiency.
Easy to accommodate.
Durability with little attention.

WHEN INCORPORATING THE LE BLANC ROTARY AIR PUMP

Fluctuations in Boiler steam pressures do not affect the plant, which makes it specially suitable for Collieries and Steel Works.
Highest vacuum is maintained.

Further information on application.

MIRRLEES WATSON COMPANY LIMITED
ENGINEERS, 45, Scotland Street, GLASGOW
London Office - - 7, Grosvenor Gardens, S.W.1.

ERNEST NEWELL & CO., LTD.,

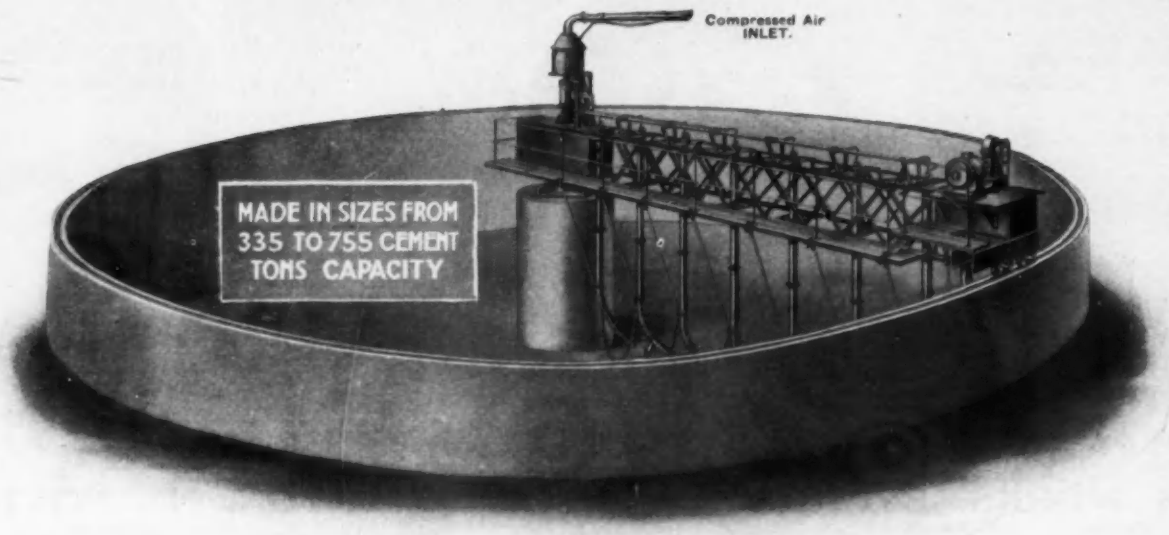
MISTERTON, *via* DONCASTER.

Telephone:
No. 11 Misterton

Telegrams:
Newells,
Misterton,
DONCASTER.

7 sets recently completed for Great Britain.

Orders in progress:—
4 Sets for FRANCE.
2 Sets for INDIA.



CODES:
Bentley's 5-Letter Code.
Western Union 5 Letter.
Western Union Universal Edition.
ABC 5th Edition.
Engineering 2nd Edition.

AIR AGITATED SLURRY MIXER.

MANUFACTURED UNDER LICENSE FROM MESSRS. THE BRITISH PORTLAND CEMENT MFRS. LTD. LONDON.

SEE OUR ADVT. IN THE NEXT ISSUE OF "THE ENGINEER" FOR GRINDING RAW MATERIALS OR CEMENT CLINKER.

THE LARGEST AND MOST EXPERIENCED BRITISH MAKERS OF

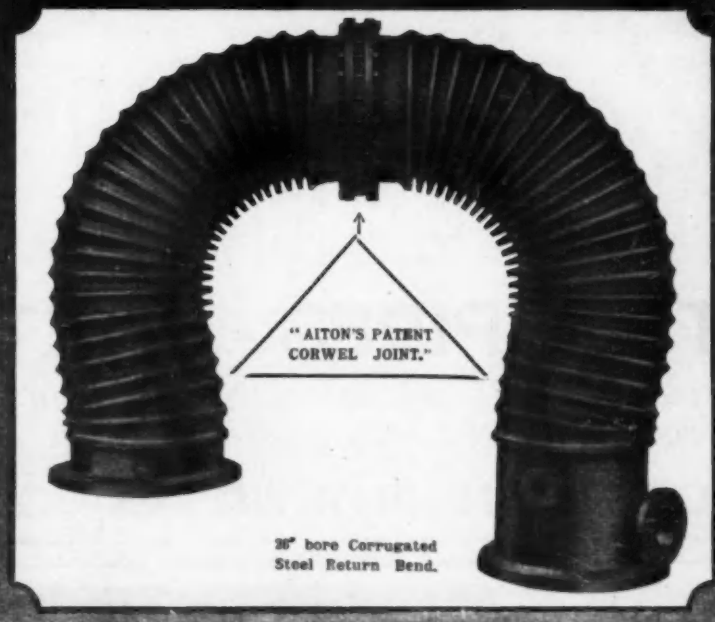
COMPLETE CEMENT WORKS.

FOR PIPEWORK OF EVERY DESCRIPTION

Aiton's of Derby have a world-wide reputation as manufacturers of first-class pipework; included in their range are cast-iron pipes from 2in. to 72in. bore, welded pipes, creased pipes, corrugated steel expansion pipes and tanks up to large sizes; in addition Aiton's make Steam Traps and all accessories. Complete installations erected in all parts of the world.

All Aiton pipework is manufactured with the strictest accuracy, while long experience and continual research enable Aiton's to undertake work at any pressure or temperature of steam which engineers may wish to use.

The illustration shows a 26in. bore Corrugated Return Bend, fitted with Aiton's Patent "Corwel" Joint, which is acknowledged to have no rival for the highest steam pressures and temperatures.



26" bore Corrugated Steel Return Bend.

AITON & CO. LTD
DERBY.

MIDLAND FLEXIBLE METALLIC TUBING CO. LTD.

MANUFACTURERS OF

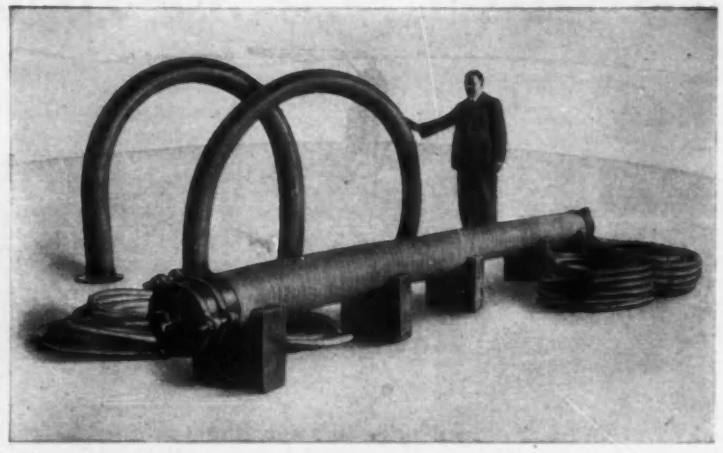
"MIDFLEX" TUBING, FLANGES, CONNECTIONS, Etc.

INTERLOCK. HIGH PRESSURE STEAM, OIL or WATER

HIGH RIDGE. STEAM, OIL or WATER.

FIREPROOF. COPPER or STEEL.

A.P.R.P.S. EXHAUST, DUST EXTRACTION, VENTILATION, Etc.



CABLE ARMOUR ELECTRIC WIRE COVERING and PROTECTION.

RUBBER PACKED GAS.

DUPLEX HIGH PRESSURE TUBING.

ELECTRIC FLEXIBLE ARMS.

ALL TYPES OF FITTINGS SUPPLIED TO CUSTOMERS' REQUIREMENTS. *On Admiralty & War Office Lists.*

VULCAN WORKS, BRIDGE STREET, LONG EATON, Nr. NOTTINGHAM.

Telephone—LONG EATON 50. Telegrams—"FLEXIBLE."

Howell's cold-drawn weldless

STEEL BOILER TUBES

give the maximum resistance to corrosion.

Howell & Co Ltd SHEFFIELD TUBE WORKS Sheffield.

MECHANS LIMITED

STEEL PIPES - RIVETTED OR WELDED

FOR ALLUVIAL MINING—HYDRO-ELECTRIC SCHEMES—GAS WORKS—COLLIERIES—POWER HOUSES (CIRCULATING WATER & EXHAUST STEAM)—TURBINES, Etc.

SCOTSTOUN IRONWORKS, GLASGOW.

LONDON: 10, PRINCESS ST., S.W.1.

HUNT

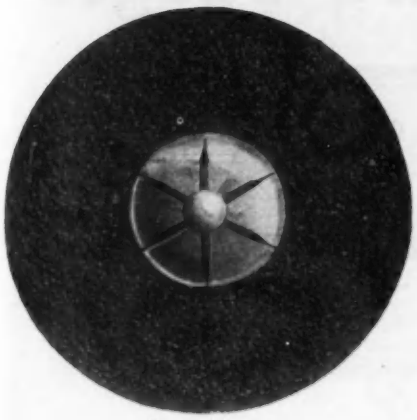
TAP SHARPENING MACHINES and TWIST DRILL SHARPENING MACHINES

FOR PARTICULARS

HERBERT HUNT & SONS, OLD TRAFFORD, MANCHESTER.

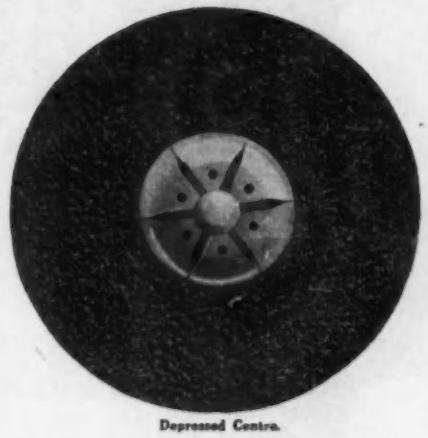
DAVIES DEMONITE DISCS —

for all types of grinding machines.



Depressed Centre.

Flat.



Depressed Centre.

From the big 53 heavy Disc to the small Portable Sander type as shewn above. **First in 1901 and still the best!**

Established 1683.

Codes: A B C 6th Edn. Bentleys.

W. J. DAVIES & SONS, LIMITED,

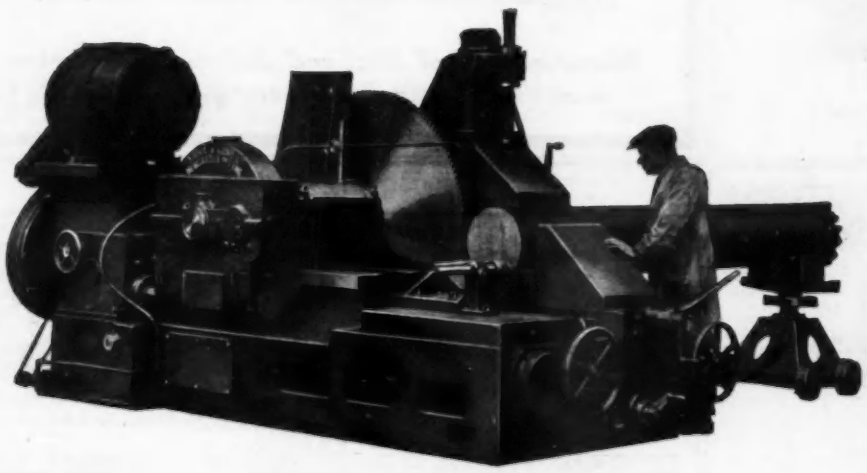
109, WESTON STREET, LONDON, S.E. 1.

Telegraphic address: Emery Berm London.

Telephone: Hop 1039

HEAVY DUTY COLD SAWING MACHINES.

MODEL C.S. 3.



The illustration shows a large machine fitted with 60″ diameter blade.

The Saw teeth are formed in segments of high speed steel ensuring maximum production.

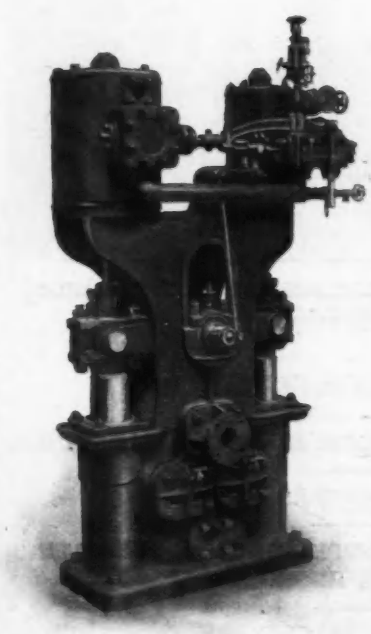
We have machines cutting steel billets up to 20″ square section in 65/70 tons tensile steel.

These machines are made for rapid cutting of steel bars, billets, girders, rails, etc., and can be supplied in various sizes to meet requirements'

Please send your enquiries to

NOBLE & LUND LTD.

FELLING-ON-TYNE.



The "BEAM" COMPOUND STEAM PUMP

FOR HIGH-PRESSURE BOILER FEEDING.

The most economical Feed Pump yet brought out.
Compound steam cylinders.
Outside packed ram type.
The result of a hundred years' experience.

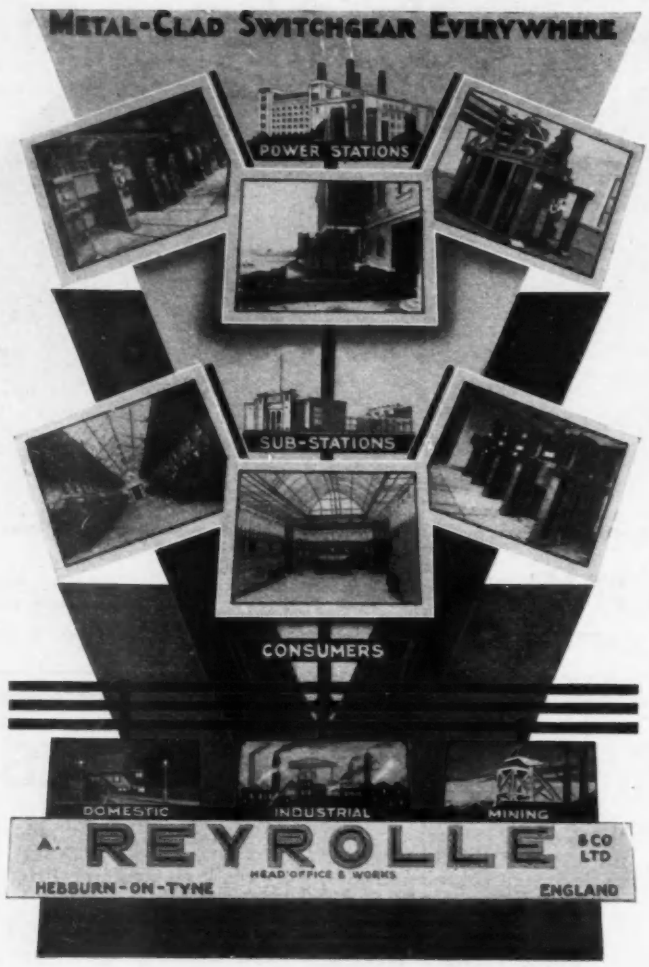
JOSEPH EVANS & SONS (Wolverhampton), LTD.

Culwell Works - - - WOLVERHAMPTON.

London Office:—109, Kingsway, W.C. 2.

Telephone: Holborn 1091.

Telegrams: "Evans, Wolverhampton." Telegrams: "Dryosbo Westcent, London."



Budenberg Gauges

For every purpose. In every size. For every pressure from 1 in. of water column up to 40 tons per square inch.

Budenberg Gauge Co., Ltd.,

Broadheath, near Manchester.

Manufacturers of Dial and Self-recording Instruments for Pressure, Temperature and Speed.

DANGER! POINTS!

SAFEGUARD THEM WITH

NON-LINK POSITIVE LOCK WASHERS

THE NON-LINK POSITIVE

The washers that grip and grip tight. No amount of vibration will loosen their hold on nut and backing. They will not injure the nut, its thread, or the thread of the bolt. Vibration, the bugbear of all machinery, is the factor that causes them to grip—the greater the vibration the more firmly they hold. Fit Non-Link Positive Lock Washers now at every danger point—that is between every nut and backing—ensure a longer lease of life for your machinery by making vibration *work for you* instead of against you.

SEE HOW IT GRIPS!

Price list on request.

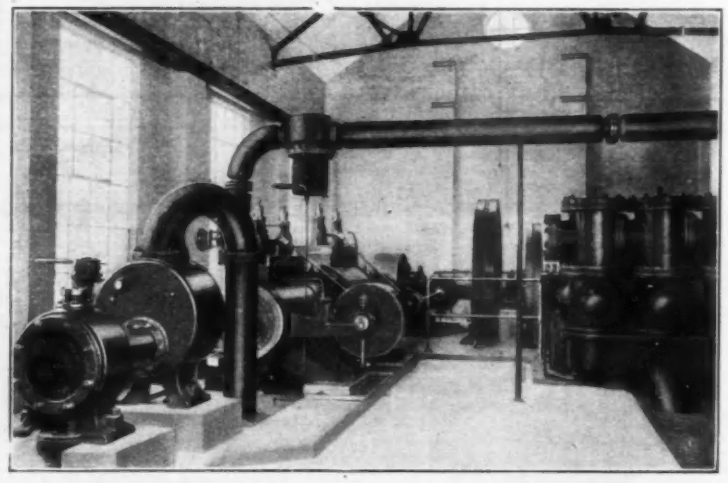
POSITIVE LOCK WASHER Co., Ltd.,
21, YORK STREET, GLASGOW.

EASTON & JOHNSON LTD

TAUNTON, ENGLAND.

Telephone: TAUNTON 146.

Telegrams: "EASTWALD TAUNTON." Code, ABC 5th Edition or Bentleys.



THIS ILLUSTRATION SHOWS ONE OF OUR D.P. TYPE 200 B.H.P. TANDEM COMPOUND STEAM ENGINES INSTALLED IN A PUMPING STATION.

STANDARD MANUFACTURERS.

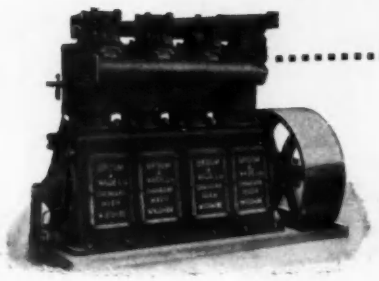
CROSS COMPOUND & TANDEM HORIZONTAL ENGINES.

CONDENSERS.

HIGH SPEED ENCLOSED TYPE FORCED LUBRICATING VERTICAL ENGINES.

SAW MILL MACHINERY.

"BROOMWADE" Air Compressors



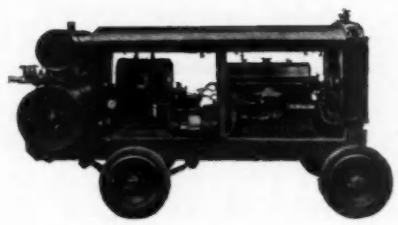
In all parts of the world where Air Compressors are used the trade-mark "BROOMWADE" has during the past **30** years become the Hallmark of maintained High Efficiency and Reliability.

30 years of specialised experience and continuous improvement in design and methods of manufacture has made the "BROOMWADE" Air Compressor a product of which both manufacturer and user can be justly proud.

Reciprocating and Rotary Compressors, Stationary or Portable Types to suit all duties.

Catalogues and other information on request.

THEY ARE 100% BRITISH MADE. COMPETITIVE IN PRICE, AND PRE-EMINENT IN VALUE.



BROOM & WADE LTD. HIGH WYCOMBE.

VALOR
Storage Equipment for Lubricating Oils

THREE 150-gallon tanks fitted with adjustable self-measuring pumps, barrel cradle and dash for indoor storage.

These can also be supplied in 50, 100, 200, 250 and 300-gallon sizes fitted with quart pumps, semi-rotary or gear oil pumps as alternatives.

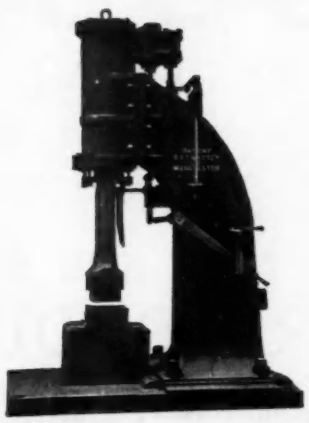
We are manufacturers of all types of outdoor Storage Equipment, comprising a Sliding-door Cabinet of 55 gallons capacity, barrel covers, drum, shelters, portable outfits, etc., fitted with pumps as above or customers' own pumps where desired. We are in a position to give prompt delivery of standard models and are prepared to quote customers' own design and finish where desired.

Write to-day for List 40V/53 and prices.

THE VALOR CO., LTD.,
VALOR WORKS, Bromford, Erdington, BIRMINGHAM.
LONDON : 120, Victoria Street, S.W. 1.

L.1.

B & S STEAM HAMMERS AND



RIGBY TYPE.

3 CWT. TO 60 CWT.

COMPRESSED AIR HAMMERS
WITHOUT SLIDES
as illustrated.

These Hammers are fitted with **MASSEY'S HAND-WORKED EXPANSION VALVE GEAR**, thus securing the greatest possible economy in steam or air consumption, and at the same time accurate and complete control.

There is no risk of striking the cylinder cover and no shock to the driver's hand.

May we send you particulars?

B. & S. MASSEY LTD.
OPENSHAW MANCHESTER

East Ferry Road Engineering Works Co.,
LIMITED.
Hydraulic Cranes and Coal Hoists, Belt Conveyors for Coal, &c.
Patent Pneumatic Grain Elevating Machinery.
ELECTRIC JIB CRANES

2-tons capacity Electric Luffing Cranes supplied and erected by us on a Wharf on the River Thames.

HYDROSTATIC CRANE WEIGHING MACHINES
Engines, Pumps, Sluices, Capstans, &c. General Engineers & Ironfounders.
Estimates given for Repairs.
Telegrams—Hydrostatic, Phone, London
Telephone—East 3848 & 3849.
MILLWALL, LONDON, E. 14.

SPECIALITIES

Feed Water Regulators

Oil Fuel Control Gear
for Low Water Level Alarm

Vertex (Patent)
High Efficiency
PUMPS
Steam or Electrically Driven.

Special Centrifugal
Circulating
Pumps
Steam or Electrically Driven.

Patent Rotary
Piston Steam
Engines.

A. G. MUMFORD LTD.
COLCHESTER.
LONDON OFFICE: 101, Leadenhall Street.

GENERAL

Direct Acting
Steam Driven
Pumps
for Marine and Land purposes.

Oil Pumps
for Tankers & Oil Refineries.

Auxiliary
Condensing Plants
with Combined Air and Circulating Pumps, Simplex or Duplex Types.

Marine Machinery
for Tugs, Trawlers, &c.

Specially Equipped for all Classes of Coppersmiths' Work.

MOSS
Industrial Gear Units

This Moss Worm Reduction Gear Unit, double reduction, 350/600 type, giving a reduction of 720 : 1, is typical of our ability to meet EVERY reduction need.

Write now for full details of this and other Moss Gear products.

THE MOSS GEAR CO., LTD.,
Crown Works, Tyburn, BIRMINGHAM.
Scottish Agents: E. SIMMONS & CO., 164, Howard St., Glasgow

WE ARE THE ORIGINAL MAKERS OF THE

SUPERHEATERS
FOR EVERY TYPE OF BOILER

We have no connection with any other Company purporting to make this type Superheater.

We have an expert staff of Technical Engineers, whose services and knowledge in connection with Superheaters are available at all times.

Enquiries solicited for all classes of Steam Pipework in Solid Drawn Steel.

Please note particularly our Swansea Address :
"Unit" Superheater & Pipe Co., Ltd.,
UNIT WORKS,
SWANSEA.
Registered Office :—
Bush House, Aldwych, London, W.C. 2.

RUSSIA
IS BUYING

Machinery and Equipment for every branch of Industry, Agriculture, Public Administration, Transport and Scientific Construction; also Raw Materials and Semi-Manufactured Goods.

SEE THAT SHE BUYS
YOUR PRODUCTS.

Bring them to the attention of Russian Factory Managers, Technicians, Engineers, Industrialists, Scientists, Trusts, Co-Operative Organisations, Concessionaires, Technical and Scientific Institutions, &c., &c., IN RUSSIA, by means of advertisements, articles and illustrations in the

Британско-Русский Журнал

&

Торговое Обозрение.

(PRINTED IN THE RUSSIAN LANGUAGE.)

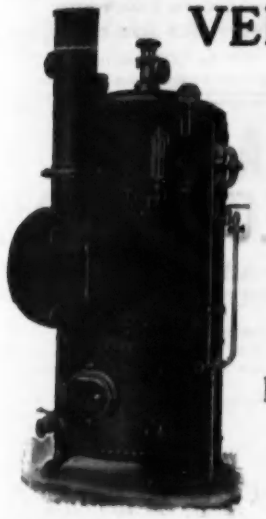
Specially recommended for this purpose by the Russian Commissariat for Foreign Trade, Moscow.

PUBLISHED BY THE
British-Russian Gazette & Trade Outlook, Ltd.
Walter House, Bedford St., London, W.C. 2. (Temple Bar 1180.)

SEND FOR SPECIMEN COPY AND RATES.

WALTER W. COLTMAN

VERTICAL BOILERS.



VERTICAL CROSS-TUBE BOILERS FOR IMMEDIATE DELIVERY FROM STOCK.

PRICES AND PARTICULARS ON APPLICATION.

THE WALTER W. COLTMAN VERTICAL MULTITUBULAR BOILER.

STANDARD VERTICAL CROSS-TUBE BOILER.

WALTER W. COLTMAN & CO., LTD.,

CENTRAL BOILER WORKS, **LOUGHBOROUGH,** ENGLAND.

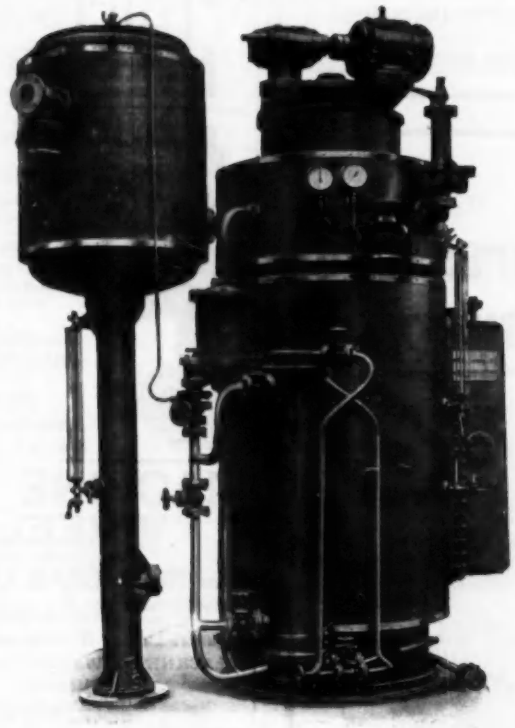
Telephone: 51 LOUGHBORO. Codes: A.B.C. 5th and 6th Edition, BENTLEY'S. 'Grams: BOILERS, LOUGHBORO

THIS EVAPORATOR IS.....

.....UNIQUE.....

.....BECAUSE.....

SCALE CANNOT ADHERE to its heating surfaces.



There are no delays with the CLARKE CHAPMAN EVAPORATOR PLANT (Engisch Patent) because the disc-shaped heating elements are continuously cleaned.

A CONSTANT OUTPUT is maintained.

We invite you to send for our No. 83 pamphlet describing the Clarke-Chapman Evaporator Plant (Engisch Patent).

CLARKE CHAPMAN & CO. LTD

VICTORIA WORKS

GATESHEAD

TEL. NOS: GATESHEAD 72271 (3 Lines) TEL. ADD. "CYCLOPS, GATESHEAD"

STOTHERT & PITT LTD

BATH ENGLAND

CALCUTTA, INDIA

24 ELECTRIC HORIZONTAL LUFFING DOCKSIDE CRANES

2 TONS AT 55'-6" RADIUS

BOLTS & NUTS, ETC.

Speciality:—**FACED** and **BRIGHT NUTS.**

LISTS ON APPLICATION.

USUAL STOCK - 1000 TONS.

BRIGHT DRAWN STEEL BARS.

JAMES WILEY & SONS, Ltd., DARLASTON.

highly efficient transport . . .

No further proof is needed of the efficiency of Breco Aerial Ropeways than the fact that they are operating with every satisfaction in all parts of the world. We are proud of many of the engineering achievements — difficulties have been surmounted which were considered next to impossible. Breco Aerial Ropeways will cut down overhead costs.

Write for our booklet which illustrates and describes the Breco Aerial Ropeway system.

BRECO
AERIAL ROPEWAYS
BRITISH ROPEWAY ENGINEERING CO., LTD.
14, 15, HIGH HOLBORN, LONDON, W.C. 1
TELEPHONE: CHANCERY 8521. TELEGRAMS: "BRERACLING, HOLB., LONDON."

CARRON *Patent Simultaneous Fastening Sidelight.*

By Appointment Ironfounders to H.M. the King.

THE advantages of this Sidelight are watertightness ensured by the equal distribution of binding pressure on the rubber jointing and the dispensing with the ordinary Screw Fastenings. Binding is accomplished at one operation by less than one turn of the operating handle or lever. The same movement in the opposite direction releases the binding leaving window free to be opened.

No. 32G Illustrated Sidelight Catalogue post free.

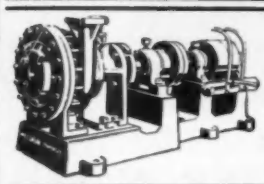
As supplied to "Aorangi" and "Bermuda," and "Rangitiki," "Rangitata," and "Rangitaiwe," of New Zealand Shipping Co., Ltd.

Contractors to the Admiralty & Principal Shipbuilding Companies at home and overseas.

CARRON COMPANY FOUNDED 1759. ENGINEERING DEPARTMENT CARRON, STIRLINGSHIRE

H. W. KEARNS & CO., LD.
BROADHEATH, MANCHESTER.
MACHINE TOOLS FOR ENGINEERS.
Tel. No. 221 Altrincham.
See our Illustrated Advertisement in issue of June 19

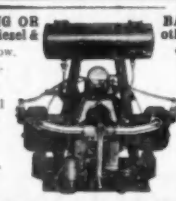
LEA RECORDERS
For all purposes, where ACCURACY is required.
Write for latest information to:—
THE LEA RECORDER CO., LTD.,
Recorder House, Cornbrook Park Road, MANCHESTER.



MELDRUMS TIMPERLEY, for ACID RESISTING METALS.

MICHELL BEARINGS, Ltd.
ENGINEERS & MANUFACTURERS OF
Michell Thrust & Journal Bearings
Registered Office and Works:
South Benwell, Newcastle-on-Tyne.

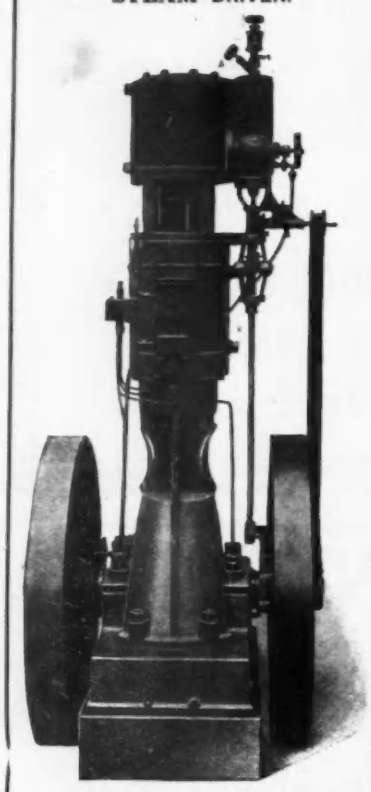
STARTING OR For large Diesel & other Prime Movers.
Prices Low.
A light, compact motor, running on a very small quantity of Petrol or light Oil.
'Grams: "Precision." 'Phone: 5054 & 5055.



BARRING ENGINE other Prime Movers.
Quick Delivery.
Starts instantly & exerts a steady even torque.
Sizes to start any engine. Write for Catalogue El.
The COVENTRY VICTOR MOTOR Co. Ltd., Coventry

Paterson
ENGINEERING COMPANY LTD.
FILTERING STERILISING SOFTENING
WATER WORKS ENGINEERS
PURE WATER

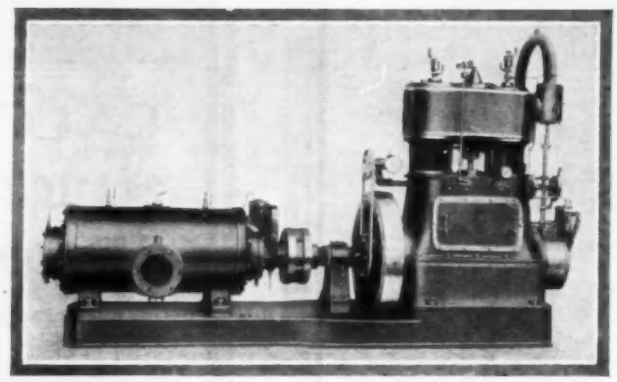
AIR COMPRESSORS
BELT, ELECTRIC, PETROL AND STEAM DRIVEN.



LACY-HULBERT & CO.
LIMITED.
BOREAS WORKS, BEDDINGTON, Nr. CROYDON, SURREY.
91, Victoria Street, WESTMINSTER.

HOLLAND S M TRADE MARK

Rotary Air Compressors and Vacuum Pumps



Rotary Vacuum Pump direct coupled to High Speed Steam Engine.

ROTARY MOTION	DIRECT COUPLING
NO VALVES	NO VALVE SPRINGS
NO PULSATIONS	NO VIBRATION

OVER 8,000 MACHINES IN USE.

Bernard Holland & Co.
17 Victoria Street, London, S.W.1.

GOVERNORS
PICKERING TYPE,
and with Smith's Patent Knock-off Gear.
SIMPLE, EFFICIENT.
Jockey Pulley Abandoned.
Operates if Governor Stops from any cause.
Sole Licensees and Makers:
POLLOCK, MACNAB AND HIGHGATE,
Shettleston, GLASGOW.
Makers to War Office & Admiralty

MACHINE CUT WHEELS.
The REID GEAR Co., Linwood, nr. Paisley.
See Illustrated Advert. in issue of June 5th.

Urquhart Lindsay & Robertson Orchar, Ltd.
BLACKNESS & WALLACE FOUNDRIES, DUNDEE.
Machine-moulded and Machine-cut Gears of every description and any size.
SHAFTING, FIXINGS, PULLEYS & GENERAL ENGINEERING.
See illustrated Advertisement last week and next.

WHITECROSS
SPECIAL COATED ELECTRODES FOR ARC WELDING
Types & Qualities for all purposes
THE WHITECROSS COMPANY LIMITED WARRINGTON ENGLAND

A BOOKLET DESCRIBING
BIBBY COUPLINGS
Will be sent to any Engineer by
THE WELLMAN BIBBY CO. LTD.,
VICTORIA STATION HOUSE, VICTORIA ST., LONDON, S.W.
Telegraphic Address: Couplings, Sowest, London.
Telephone No.: Victoria 7752-3-4.

GOODALL CLAYTON & Co LTD
LEEDS
CONVEYING PLANTS, BUNKERS &c

WATER SOFTENERS.

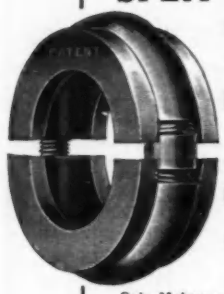
SOFTENING 1500 GALLS. PER HOUR AT KENT COUNTY ASYLUM.

Bowes, Scott & Western, LTD.,
PARLIAMENT MANSIONS,
VICTORIA STREET, WESTMINSTER, S.W.1.
(Opposite Post Office.)
Telephone No.: Victoria 3415
Telegraphic Address: Donbowes, Vic., London.

Hundreds of Softeners supplied and treating successfully the most difficult water.

Also Maker of all Types of
MINING MACHINERY, PUMPS, &c.

TRIER'S PATENT
"SPLIT GRIP" COLLAR



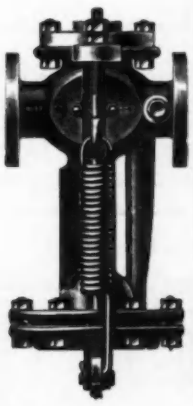
As useful as a split pulley,
MADE IN HALVES.
No set screw to Cause Accidents.
GRIPS LIKE A VICE.
Fixed or removed without Disturbance.

Sole Makers—
TRIER Bros. Ltd.,
36, Victoria St., Westminster, S.W.

AULD'S VALVES.

FOR ALL PURPOSES.

ENSURE
SIMPLICITY
ACCURACY
RELIABILITY
AND
DURABILITY.
—o—

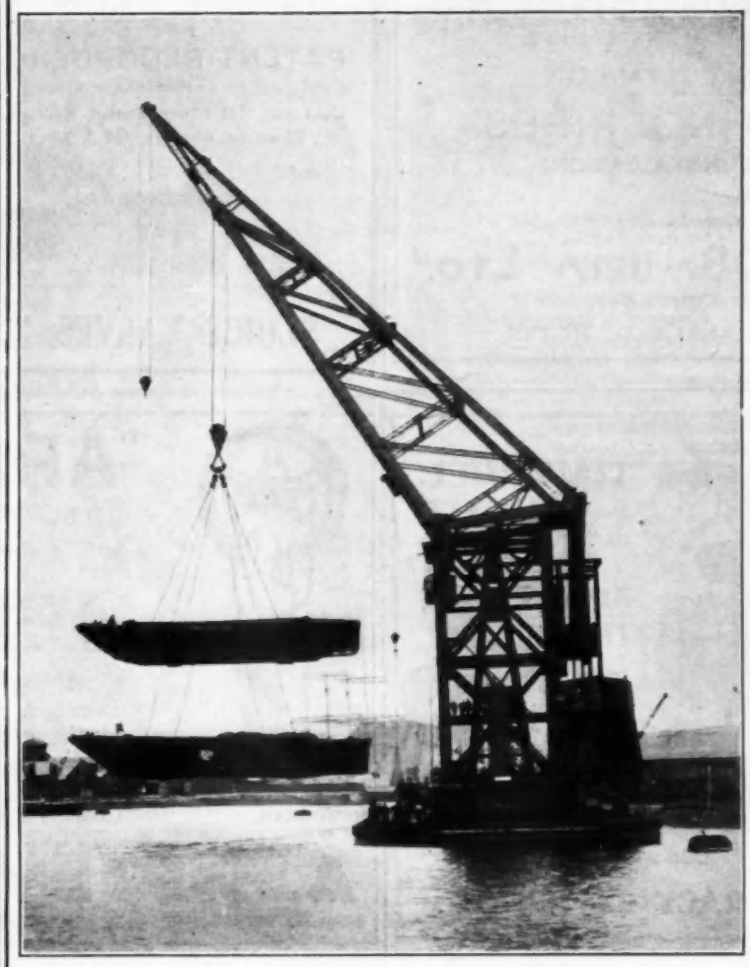


TELEGRAMS:
"REDUCING."
CODES:
A B C 5TH ED.
ENG. 2ND ED.

DAVID AULD & SONS, LTD.
WHITEVALE FOUNDRY,
GLASGOW.

SOOT BLOWERS
for Water Tube Boilers & Economisers.
Complete flue-cleaning and dust collecting installations for Lancashire Boilers.
The British Soot Blower Co., Ltd., Preston.

FLOATING CRANES

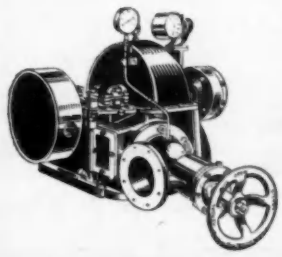


150 Ton Electric Floating Crane.

COWANS, SHELDON & Co., LD.
CARLISLE, ENGLAND.

"ATKINS" SOCKET SCREWS
HEAD AND GRUB
(B.S.W., B.S.F., S.A.E., GAS and DARDELET Threads)
IN HIGH-TENSILE STEEL
HARDENED & TEMPERED

Full Particulars and Samples from
BRITISH DARDELET THREADLOCK LIMITED,
CHASE ROAD, LONDON, N.W.10.



WATER TURBINES and GOVERNORS for any power or height of fall.

CENTRIFUGAL PUMPS.

Gilbert Gilkes & Gordon, Ltd.,
Kendal,
England.
London Office: Windsor House, Kingsway, W.C.2.

REFRIGERATING PLANT
on the ammonia and CO2 systems for
Marine Work

The special requirements of the Shipping world are fully catered for in Haslam Refrigerating Machinery, which has been designed specially for sea-going vessels and has been installed by many of the leading shipping lines throughout the world.

In addition to the manufacture of Refrigerating Plant for both marine and land work, Haslams can also supply Copper and Brass work of every description, Evaporators, Mixing Vessels, Filter Presses, Caustic Pots, etc., and undertake general Loam and Casting work up to 15 Tons.

Haslam
HASLAM & NEWTON LTD.

HEAD OFFICE & WORKS: DERBY.
Telephones: 778 and 779 Derby.
Telegrams: "Zero," Derby.
London Office: Imperial Buildings, 56, Kingsway, W.C.2.

EI 5

Permac
"PERMAC" JOINTS RESIST HIGHEST PRESSURES
"PERMAC" JOINTS DO NOT RUST
EASILY REMOVED WHEN REQUIRED
THOMAS & BISHOP LTD.
37 TABERNACLE ST. LONDON, E.C.2

CRANE FOR SHIPYARD USE

CRANES
OF ALL TYPES,
STEAM, ELECTRIC OR OIL ENGINE

KENT STREET
TAYLOR & HUBBARD LTD.
LEICESTER

Telegrams Lifting, Leicester. Telephone No. 575

SPRAY COOLING PLANTS

STEAM & WATER-JET APPARATUS
OF ALL DESCRIPTIONS.

MULTI-JET CONDENSERS

FOR TURBINES and RECIPROCATING ENGINES.

GAS EJECTORS FOR OIL TANKERS.

GILLED HEATING PIPES.

COMPLETE HEATING INSTALLATIONS.

Catalogues on Application.

KORTING BROS. (1917) LTD.

(AN ALL-BRITISH COMPANY)

SHEEPBRIDGE LANE, MANSFIELD, NOTTS.

GUEST & CHRIMES, LTD.

ROTHERHAM.

LONDON OFFICE: CECIL CHAMBERS, 76, STRAND, W.C.2.

VENTURI METERS
WITH
PATENT RECORDERS.
FOR
Cold and Hot Water, Steam, Sewage, Chemical Liquors, Oil & Air.

"TURBINE"
"CAPSTAN"
"PLANET"
AND
"SPIRAL"
METERS.

SLUICE VALVES All kinds of Waterworks Constructional Articles, including High Pressure Taps.

THE
TIMBRELL & WRIGHT
MACHINE-TOOL & ENG. CO. Ltd.
SLANEY ST.,
BIRMINGHAM.
TELE PHONE: CEN. 3723.
GRAMS: REVOLVING.

GIVE A HIGH RATE OF PRODUCTION

T&W CAPSTAN LATHES T&W

COMBINED WITH
ACCURACY and FINISH.

"APS" LIFTS

ELECTRIC and HYDRAULIC
FOR ALL PURPOSES.

A FEW RECENT "APS" CONTRACTS

S.S. "KENYA." S.S. "KARANJA."

G. & J. Weir, Cathcart.
Penang Municipality.
Houldsworth Homeopathic Hospital.
Birmingham Corporation.
Coldbreck, McGregor & Co., Singapore.
Cooper & Co., Glasgow.

LONDON: 10, CHARLES ST., S.E.1.
MANCHESTER: 12, CHARLES ST.
BIRMINGHAM: 63, HOCKLEY HILL.

A. & P. STEVEN, LTD. ST. JAMES RD. GLASGOW.

SPENCER-HOPWOOD BOILERS

for

COAL, COKE, OIL or WOOD FUELS.

1. Low Initial Cost.
2. Quick Steaming.
3. Economical in Fuel.
4. Small Floor Space.
5. High Evaporative Capacity.
6. No Expensive Brick Setting.
7. No Expensive Chimney.
8. Smokeless Combustion.

SPENCER-HOPWOOD LIMITED,
SCOTSWOOD WORKS, NEWCASTLE-UPON-TYNE.

Maintain a Constant Pressure
at your Gas Appliances
and SAVE GAS with

DONKIN GAS REGULATORS

We supply them for
GAS METERS, FIRES, STOVES, GEYSERS, RADIATORS, and for Gas Services for High and Low Pressures

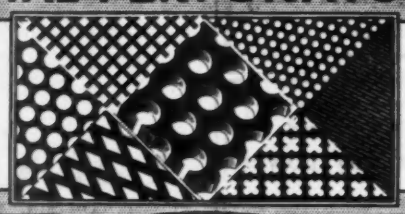
These Regulators save Gas by preventing waste due to irregular and excessive pressure.

(Associated Company: British Furnaces Ltd., Makers of all kinds of Industrial Furnaces.)

THE BRYAN DONKIN COMPANY, LTD.,
Engineers, CHESTERFIELD.

ESTAB: 1860
W. Barnes & Son
METAL PERFORATORS

WIRE WORK OF EVERY DESCRIPTION
TROMMELS & GUARDS



NAME PLATES
CHEMICALLY ENGRAVED
CAST BRASS ENAMELLED IRON &C.

ALL PERFORATED METALS
PLATES & SHEETS
TO SPECIFICATION.
SHAPES OF HOLES
FOR ALL PURPOSES

Globe Works Queensland Road
Holloway LONDON, N.7.
Telegrams: "PERFORATION" LONDON. Telephone: NORTH 0761.

PEGSON VIBRATORY SCREENS

SAMUEL PEGG & SON,
ALEXANDER ST.,
LEICESTER.

Clear sharp separation and a live pulsating surface that cannot clog.

CRANES

ALL TYPES

ELECTRIC, STEAM, HYDRAULIC, HAND,

FOR

SHIPYARDS, DOCKS, STEEL WORKS, ETC.

JOHN GRIEVE & Co.

MOTHERWELL, SCOTLAND.

Price list free.

J. H. HEATHMAN

PARSONS' GREEN, FULHAM,
LONDON, S.W. 6.

GIMSON & CO. (LEICESTER) LTD.

SOLICIT YOUR ENQUIRIES FOR ALL CLASSES OF MACHINERY

ESPECIALLY DEEP WELL PUMPS.

CAST IRON AND STEEL TANKS.

ALL KINDS OF RIVETTED OR WELDED MILD STEEL VESSELS.

ELECTRIC LIFTS.

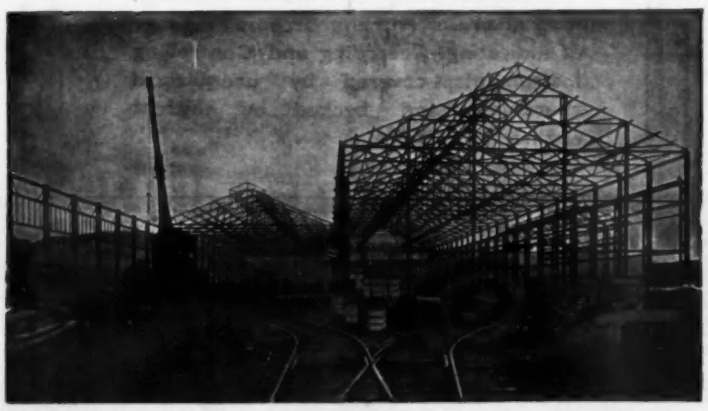
POWER TRANSMISSION.

ALL CLASSES OF IRON CASTINGS AND ACCURATE MACHINING.
SPECIAL PURPOSE MACHINES DEVELOPED FROM ROUGH DRAWINGS.

VULCAN ROAD——LEICESTER.

STEEL FRAME BUILDINGS

OF EVERY DESCRIPTION.



BROWNLIE & MURRAY LD., Possil Park, GLASGOW.

LONDON: 59-60, GRACECHURCH ST., E.C. 3.

CATALOGUES FREE ON APPLICATION. REFER NEW EDITION A.

THE STEEL COMPANY OF SCOTLAND, LTD

SIEMENS PROCESS

EST'D HALLSIDE 1872

37 RENFIELD STREET, GLASGOW, C.2

WORKS: HALLSIDE, NEWTON, and BLOCHAIRN, GLASGOW.

OFFICES: 37, RENFIELD ST., GLASGOW, and 9, MINCING LANE, LONDON.

CONTRACTORS TO BRITISH ADMIRALTY, WAR DEPARTMENT & FOREIGN & COLONIAL GOVERNMENTS

Manufacturers of

MILD STEEL Plates for Ship, Boiler and Bridge-building, and all forms of Sectional Bars for constructive purposes.

CASTINGS of all kinds and largest sizes for Ships and Machinery

FORGINGS of every description.

TYRES & AXLES, to meet requirements of Home and Colonial Railways.

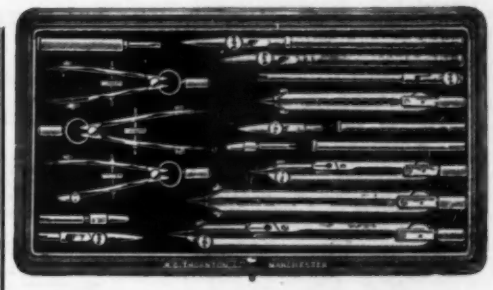
SPECIAL STEEL for constructive purposes, including Steel of High Elastic Limit and Copper Bearing Steel.

= THORNTON =

Largest Manufacturers of High Grade Drawing Instruments in the British Empire.

Also Manufacturers of Surveying Instruments, Slide Rules and Drawing Materials.

Many awards for excellence, including Diploma, Gold and Silver Medals, etc.



Catalogues, Series A 18, Post Free.

A. G. THORNTON, Ltd.

Contractors to the British and other Governments,
PARAGON WORKS, King Street West, MANCHESTER

GRAFTON & CO.

CONTRACTORS TO H.M. GOVERNMENT

ATLAS WORKS

Telegrams: GRAFTON, BEDFORD. **BEDFORD.**

Illustrated Descriptive List free on application.

SILVER MEDAL, Inventions Exhibition, London, 1885.
GOLD MEDAL, PARIS, 1900.
GRAND PRIX & GOLD MEDAL, Franco-British Exhibition, London, 1908.
GRAND PRIX, Buenos Aires Exhibition, 1910.

FOUNDRY EQUIPMENT.

The latest types of

FURNACES, CUPOLAS, LADLES,
MOULDING AND COREMAKING MACHINES,
SAND PREPARING AND CONVEYING EQUIPMENT,
SAND BLAST MACHINES, ETC.

J. W. JACKMAN & CO., LTD.,

Vulcan Works, Blackfriars Road, MANCHESTER.

LONDON OFFICE: Abbey House, WESTMINSTER, S.W. 1.

Telegrams: "Molders, London" Telephone: 0030 Victoria.

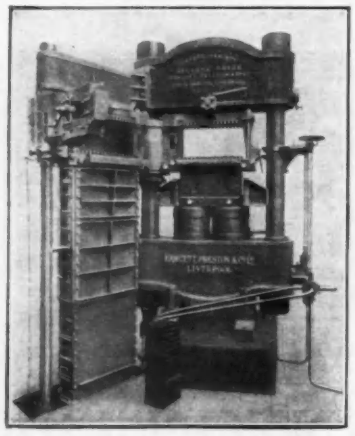
FAWCETT, PRESTON & Co., Ld.

Manufacturing Engineers, LIVERPOOL.

Telegrams: Fawcett, Liverpool.
Codes used—ABC (4th and 5th Editions), Western Union ("Five Letter" and "Universal" Editions) Bentleys and A1.

London Office:
21, OLD QUEEN STREET, WESTMINSTER, S.W.1.
Trade Mark "CYCLONE."

Contractors to the Admiralty & War Office.



Watson-Fawcett Hydraulic "Cyclone" Press.

SUGAR MAKING PLANT of all kinds.
Complete Factories supplied.

SEA WATER DISTILLING PLANT.

DISTILLING & EVAPORATING MACHINERY for all purposes.

HYDRAULIC BALING PRESSES.

Sole Makers of CYCLONE and GRID PRESSES, and of Fawcett's High Density Presses and Pumps for Packing Cotton, Jute, Wool, Hides, &c., of any required density and weight of bale.

NITRATE-MAKING PLANT.

MARINE and STATIONARY ENGINES and BOILERS.

PUMPING MACHINERY for Towns Water Supply.

COPPERSMITHS & BRASSFOUNDERS.

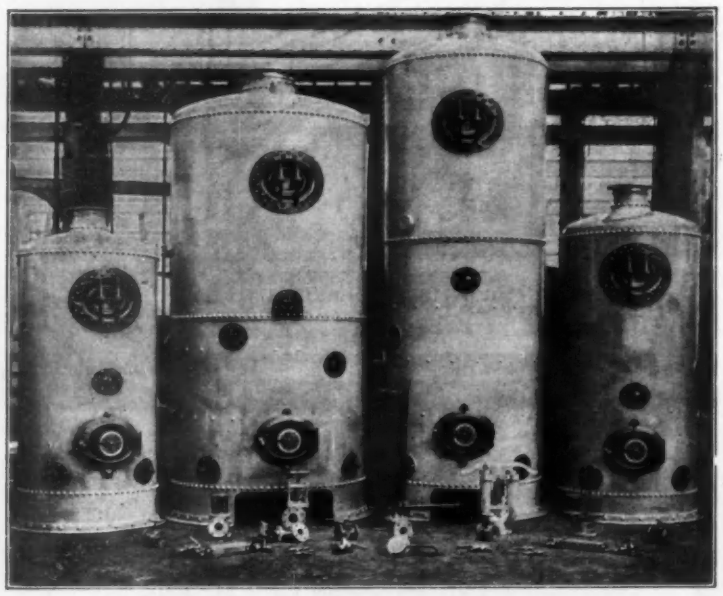
BROWN BAYLEYS STAINLESS

HEAT RESISTING STEELS

FOR CASE HARDENING AND ANNEALING BOXES, RAILS, SKIDS, GRIDS, DRUMS FOR CONVEYOR CHAINS, BAFFLE PLATES, ETC.

BROWN BAYLEY'S STEEL WORKS LTD. SHEFFIELD

Clayton, Son & Coy., Ltd.



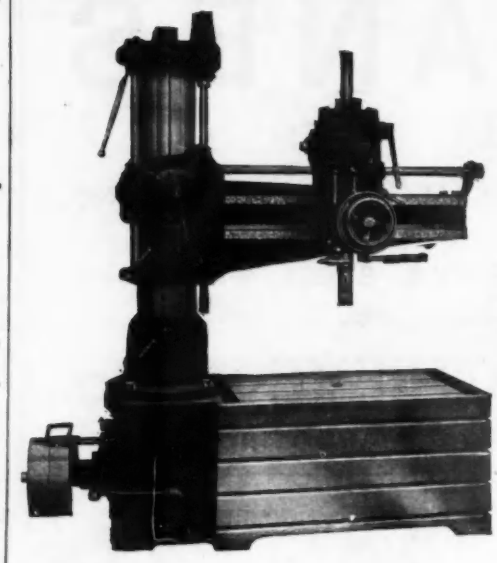
MOOR END, HUNSLET, LEEDS.
WIRES: "GAS, LEEDS."

High Class CLAYTON CROSS-TUBE BOILERS

Large Stock in Hand Ready for Prompt Delivery

PRICES AND PARTICULARS ON APPLICATION. London Office: 5, VICTORIA STREET, S.W.1.

DRILLING & BORING SPECIALISTS.



DRILLING, BORING TAPPING & STUDDING MACHINES.

4 0" Elevating Arm, Box Bed Radial illustrated.

WORKING CAPACITIES.

CAST IRON, from solid		2½"
STEEL	"	" 2"
BORING ...	...	... 8"
TAPPING, Whit....		... 1¼"

We make a full range of machines for various duties.

Send for Catalogue.

Telephone: 1673. Halifax
Telegrams: KAW.
Code: Marconi International

KITCHEN & WADE, HALIFAX, ENGLAND.

SAFEGUARD TRADE MARK

BRAKE LINING

MADE BY:—

CANDYS LD., SEACOMBE, CHES., The Power Transmission Specialists.

BRISTOL'S

INDUSTRIAL INSTRUMENTS

The largest manufacturers of Industrial Instruments offer the most complete range of Indicating, Recording and Controlling Instruments covered by unequivocal guarantees and backed by efficient engineering service.

J. W. & C. J. PHILLIPS, LTD.,
23, COLLEGE HILL, CANNON ST.,
LONDON, E.C. 4.

THE MITCHELL CONVEYOR & TRANSPORTER CO., LTD.,

ALL CLASSES OF HANDLING MACHINERY.
45-50, Holborn Viaduct, LONDON, E.C. 1.
Grams: Mountrace, Cent. London. Phone: Holborn 2832.

WAGON TIPPLERS, TRANSPORTERS, CONVEYORS, TELPHERS, CRANES, LOCO. COALING PLANTS, GRABS, COMPLETE BOILER HOUSE EQUIPMENT, AERIAL ROPEWAYS.

Matchless Best Cast Steel.
Matchless C S. Circular and Band Saws for Iron and Steel.
Matchless Cast Steel Files.
ALFRED BECKETT & SONS, LTD
SHEFFIELD.

A. BEEBEE,
Bolts, Nuts, Studs, &c.
WEDNESBURY.

"RAPID"
Electro-Lifting Magnets
THE RAPID MAGNETTING MACHINE CO LTD BIRMINGHAM
Telegrams: "BORINGS, BIRMINGHAM."

WOOTTON BROS., LTD.,
COALVILLE, near LEICESTER.
Telegrams: Wootton, Coalville.
Brickworks Plant. Sanitary Pipe Plant
CLAY-WORKING PLANT.
Colliery Plant. General Millwrights.

SUPERHEATERS FOR ALL TYPES OF BOILERS.
T. SUGDEN, LTD.,
180, Fleet Street, London, E.C.4.
See Advt.—"Engineer"—June 5.

GRAIN, CHILL & STEEL **ROLLS**
HEAVY **CASTINGS** Iron up to 100 tons. Steel up to 40 tons.
Cast Steel Loco Wheel Centres a Speciality.
R. B. TENNENT, LIMITED,
COATBRIDGE, N.B.

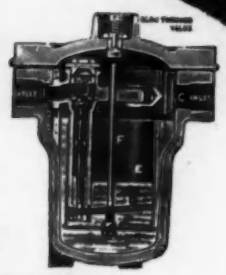
PEEBLES
ELECTRICAL MACHINERY AND TRANSFORMERS
BRUCE PEEBLES & CO. LTD., ENGINEERS, EDINBURGH.

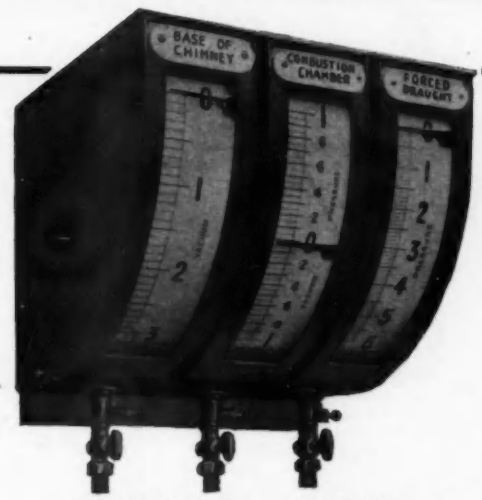
Clifton & Baird, Ltd.
Metal Sawing Machine Specialists.
Empress Works,
JOHNSTONE, SCOTLAND.

BRETTS PATENT LIFTER Co. LD
SPECIALISTS IN
DROP-FORGING EQUIPMENT
FOLESHILL WORKS, COVENTRY.

F. W. BRACKETT & Co., Ltd.,
Engineers, Colchester.
Water Screens, Pennell Wylie Filters, Pumps, Air Compressors. Iron Castings, etc.

We specialise in Packing Case Timber
TIMBER
IMPORTERS-MERCHANTS
Phone ROYAL 7547
KENNETH LONG & CO
ROTOLPH HOUSE, 10 EASTCHEAP, LONDON, E.C.3.

"THE **LANCASTER**" COMPACT BUCKET TYPE
STEAM TRAPS
Small in size but large capacity!
No attention required and perfect under all conditions.

LANCASTER & TONGE LTD.
PENDLETON - - MANCHESTER
Telephone: Pendleton 1404 (2 lines). Telegrams: "PISTONS," Manchester.



SIMMANCE PATENT
Dead-Beat Draught Gauges
can now be supplied with 'edge-wise' scales for any range.
All-metal construction.
No liquids.
No springs.
No gears.
Full information on request, without obligation.
ALEXANDER WRIGHT & CO LTD
1. WESTMINSTER PALACE GARDENS, VICTORIA STREET,
WESTMINSTER. S.W.1
Telephone: VICTORIA 1207. *Telegrams:* PRECISION, SOWEST LONDON

VAUGHAN ELECTRIC CRANES

150 Ton 4 Motor Crane. Span 65ft. 0in.
Modern Designs based on Ripened Experience of 50 years. All British Materials.
THE VAUGHAN CRANE CO., LTD., OPENSHAW, W. MANCHESTER.
'Phone: EAST 0773 (2 lines). 'Grams: VAUNTING, MANCHESTER.
LONDON OFFICE: Norfolk House, Laurence Pountney Hill, E.C.4. Tel.: Mansion House 7746.

DOUBLE HELICAL GEARS
FOR ALL PURPOSES
1 TO 2000 HP
WRITE FOR CATALOGUE
TURBINE GEARS LTD.
HYDE CHESHIRE

BEARDMORE
STEEL MANUFACTURERS, FORGE MASTERS, MARINE and GENERAL ENGINEERS.
BEARDMORE
PARKHEAD STEEL WORKS, GLASGOW, AND DALMUIR.
LONDON OFFICE: 36, VICTORIA ST., LONDON, S.W.1.

SCRIVEN
FOR
MACHINE TOOLS
SCRIVEN & CO.,
YORK STREET IRONWORKS, LEEDS.

Ritchie-Atlas CONVEYING MACHINERY
RITCHIE-ATLAS ENGINEERING CO.
ATLAS WORKS - TEMPLE - GLASGOW.

STERLING
FOUNDRY MOULDING BOXES
WHEELBARROWS
Sterling Foundry Specialties Ltd. BEDFORD.

DOUGLAS FRASER & SONS, Ltd.,
ARBROATH.
MILL GEARING, BELT PULLEYS, & ROPE PULLEYS.

TAYLOR, TAYLOR & HOBSON
of LEICESTER
invite enquiries for precision work having great accuracy. They specialize in quantity output of fine optical and engineering products.

J.B. STONE & Co's LTD.
NEW HEAVY TYPE *PATENT* **NIBBLING MACHINE**
for rapid cutting of sheet metal.
J.B. STONE & CO. LTD.
135 FINSBURY PAVEMENT
LONDON
EC2

THE FARRAR BOILERWORKS
LTD.,
NEWARK-ON-TRENT.
Makers of
BOILERS, TANKS, &c.

"PHONE: SO PENDLETON. "GRAMS "TURNSTILES, MANCHESTER"
RECORDING OR PENNY-IN-SLOT TURNSTILES
FOR SPORTS GROUNDS, RACECOURSES, LAVATORIES, ETC.
CHECK ISSUING MACHINES
FOR THEATRES, CINEMAS, &c.
W. T. ELLISON & Co LTD
ENGINEERS,
PENDLETON,
MANCHESTER.

HICK HARGREAVES
AND COMPANY LIMITED BOLTON
STEAM TURBINES
For Industrial Drives

The CLYDE STRUCTURAL IRON Co. Ltd.
Clydeside Ironworks, Scotstoun, Glasgow.
STEEL ROOFS
London Agents—GILLESPIE & Co., Ltd.,
Leadenhall Bldgs., 1, Leadenhall St., London E.C. 3.

COCKBURNS
LIMITED
CARDONALD
GLASGOW
The World Renowned Steam Valve Specialists
See Illustrated Advt. in alternate issues.

THE CLEVELAND BRIDGE AND ENGINEERING CO., LTD.
Specialists in the Design, Manufacture and Erection of Bridges, Girders, Roofs, Warehouses and all classes of Deep Foundation Work, Iron and Steel Constructional Work.
HEAD OFFICE AND WORKS—
DARLINGTON.
Telegrams: CLEVELAND, DARLINGTON. CLEVELAND, LONDON.
Telephone: No. 2710 DARLINGTON. No. 3427 CENTRAL.

THE PLENTY-STILL OIL ENGINES LTD
NEWBURY ENG.
OIL ENGINES
5 TO 500 H.P.
MARINE & INDUSTRIAL TYPES

Wm. JOHNSON & SONS,
LTD., (LEEDS)
ARMLEY, LEEDS, for
BRICK TILE BRIQUETTE CRUSHING AND GRINDING PLANT

ASHMORE BENSON PEASE & Co
STEEL PLATE CONSTRUCTIONS
CHEMICAL PLANT IN ACID RESISTING STEELS
CAST IRON WORK OF ANY TYPE.
GAS PRODUCERS
THEISEN GAS WASHERS
STOCKTON-ON-TEES.

ENGINE TYPE GENERATORS

"Not in the specification."
"Metrovick" Engine Type Generators include in their design a valuable feature not called for in a particular specification.
This additional and important factor is that of LONG AND WORLD WIDE EXPERIENCE in the production of Electric Generators for all conditions of service at home and abroad.

Send your enquiries to:
METROPOLITAN Vickers
SUBSIDIARY OF ASSOCIATED ELECTRICAL INDUSTRIES LTD.
ELECTRICAL CO., LTD.
TRAFFORD PARK ··· MANCHESTER

The DRUMMOND 3½in. Centre Lathe.
Fitted with any form of drive required—motor, countershaft, or treadle. Swings 9ins. in gap. Fully screw-cutting. Hollow mandrel. Slotted boring and milling table. Toolholder has height adjustment.
DB LTD
FOR repairs, maintenance, laboratory work, etc., the Drummond 3½ is an ideal tool. Though small in size it has a surprisingly large capacity, and can tackle a great variety of jobs. It is strongly built and will stand up to good cuts, while its accuracy is guaranteed. Note the strong cantilever bed, the massive headstock for such a small machine, and the large bearings.
Catalogues of Lathes up to 7in. centres, post free.
DRUMMOND
BROS., LTD., Rhide Works, Guildford.

The COIL CLUTCH CO., Ltd.,
Phœnix Works, Johnstone, Scotland.
Manufacturers of
COIL FRICTION CLUTCHES
For all Purposes, Powers and Speeds.
Quotations and Designs supplied on receiving particulars of application.

CRANE
VALVES & FITTINGS.
Heating, Sanitary & Oil Engineers' Supplies.
CRANE-BENNETT LTD.
Head Office & Warehouses:
45-51, LEMAN STREET, LONDON, E. 1.

DAVIES & METCALFE,
MANCHESTER LIMITED
SPECIALITIES:
INJECTORS.
ALL CLASSES.
Illustrated Advertisement every fourth week.

CASTINGS, STEEL & BRONZE
IRON & STEEL FORGINGS.
DARLINGTON FORGE LTD.
Darlington — England.

PRESENTING
THE NEW No. 4 .....

FEATURES.

General.

Exceptionally strong, rigid, cast-steel framing.
Two non-rotating axles taking the full weight of the superstructure.
One "Single-drive" shaft below the platform.
Only one set of gears below superstructure.
Accessible final chain drive.
Two-way brake to hold machine in position for digging and on an incline.
Driving and steering controlled by operator with superstructure in any position.
Big ground clearance.
Improved house — Additional windows ensure better ventilation and more light.

Shovel.

All steel box Girder boom—light but strong.
Greater strength at bucket arm pivot.
New bucket with cast steel back —improved design and shape—strong and efficient.
Simplifying and strengthening connections to bucket arms.

Dragline.

30ft. boom of mild steel—increased digging radius.
Mild steel bucket, simple and strong.

Grabbing Crane and Crane.

30ft. boom—increased working radius.

Dragshovel.

Digging depth increased from 14ft. to 16ft.
Simplified connections of bucket arm and digging rope to bucket.

..... the machine which marks the biggest advance in ½ yard excavator design and construction.

The Ruston-Bucyrus No. 4 has earned a Universal reputation for RELIABLE and ECONOMICAL SERVICE—its outstanding value is undeniably proved by the fact that nearly 700 machines have been made and sold in 5 years.

THE NEW No. 4 sets a higher standard of service even than that of the No. 4. The new machine embodies ALL THE ADVANTAGEOUS FEATURES of the old model PLUS MANY VITAL IMPROVEMENTS which place the Ruston-Bucyrus ½ yard excavator still further ahead of competitive machines.

The new Catalogue of the NEW No. 4 will greatly interest you—let us have your address.

RUSTON — BUCYRUS

RUSTON-BUCYRUS, LD.
LINCOLN - - - - ENGLAND

The
WAR OFFICE
have accepted
THORNYCROFT
3-TON SIX-WHEELERS
(Normal and forward-control types)
for their subsidy of £120
after a gruelling test over the new War Office trial ground in Wales.

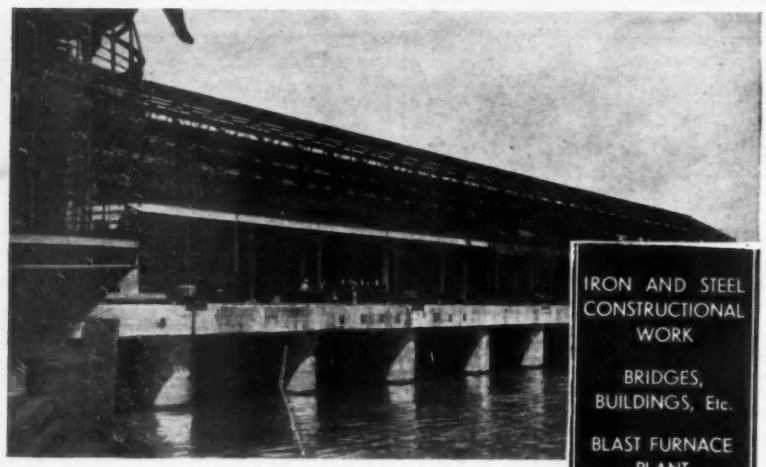
JOHN I. THORNYCROFT & CO., LIMITED.
Thornycroft House, WESTMINSTER, LONDON, S.W.1.

Eclipse-Flex
HACK SAW BLADES

"ECLIPSE" BLADES are made in four types :-
HIGH SPEED STEEL
DOUBLE EDGE
FLEXIBLE &
ALL HARD

When the work is in a difficult position or cannot be held firmly in a vice — specify "Eclipse" Flexible Blades, which are
UNBREAKABLE IN USE

Obtainable from all Tool Dealers
Made by
JAMES NEILL & CO. (SHEFFIELD) LTD.
Composite Steel Works - - SHEFFIELD.
EH.41



Transit Shed for Port of Rangoon in course of erection. Length 421ft. Width 150ft. Height 50ft. Weight of steelwork over 1300 tons, erected under difficult site conditions. Consulting Engineers, Sir Alex. Gibb and Partners.

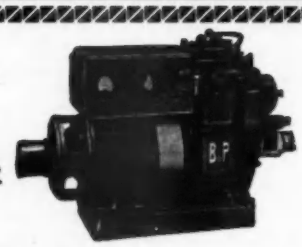
TRANSIT SHEDS BY PEARSON & KNOWLES

THE design, construction and erection of Transit or Storage Sheds for large Transport Organisations is a specialised branch of Pearson & Knowles activities.
Work of this kind is undertaken all over the world as well as at home, and among several large contracts recently undertaken is one for the Port of Rangoon illustrated above.

The **PEARSON & KNOWLES**
ENGINEERING CO. LTD.
Branch of and Agents for the Lancashire Steel Corporation Ltd.
London Office: 64, *Victoria Street, S.W.1.*
WARRINGTON, LANCASHIRE
W.C. 40

IRON AND STEEL CONSTRUCTIONAL WORK
BRIDGES, BUILDINGS, Etc.
BLAST FURNACE PLANT
STEELWORKS PLANT
COLLIERY PLANT
LOW TEMPERATURE CARBONISATION PLANT
ELECTRIC WELDING
BRASS CASTINGS
FORGINGS AND STAMPINGS
MACHINE WORK, Etc.
WAGON WHEELS AND AXLES

'Electolite Automatic'
for
LIGHT and POWER



The "Electolite" Electric Light and Power Plant is fully automatic. It starts when the load reaches about 125 watts and stops when the load is reduced to 50 watts.
There is a pulley for pump driving, etc., when not generating.
Simple to instal and operate and is automatically safeguarded against misuse.
It is a standardised engineering proposition for which it was awarded first prize.
Low in first cost and maintenance, economical in fuel and oil consumption.

Write for Catalogue 712 with Terms.

BOULTON & PAUL, LTD., NORWICH, and 139, Queen Victoria Street, London, E.C. 4.
Phone: Central 4642.

Colardo Heat Resisting Paints
METALLIC & NON-METALLIC

will withstand extreme temperatures —some colours even up to melting point of the metal on which they are applied—without changing colour, peeling or blistering.

UNRIVALLED FOR ENGINE EXHAUST PIPES, MANIFOLDS AND SILENCERS, AIR COOLED CYLINDERS, STOVES, BOILERS, FLUE-PIPES, FURNACE DOORS, HOT PIPES IN FACTORIES, LAUNDRIES, BAKERIES, ETC.

For domestic radiators, heating apparatus in Hospitals, Public Institutions and Buildings where non-metallic paints of light tints are desired they are unique.

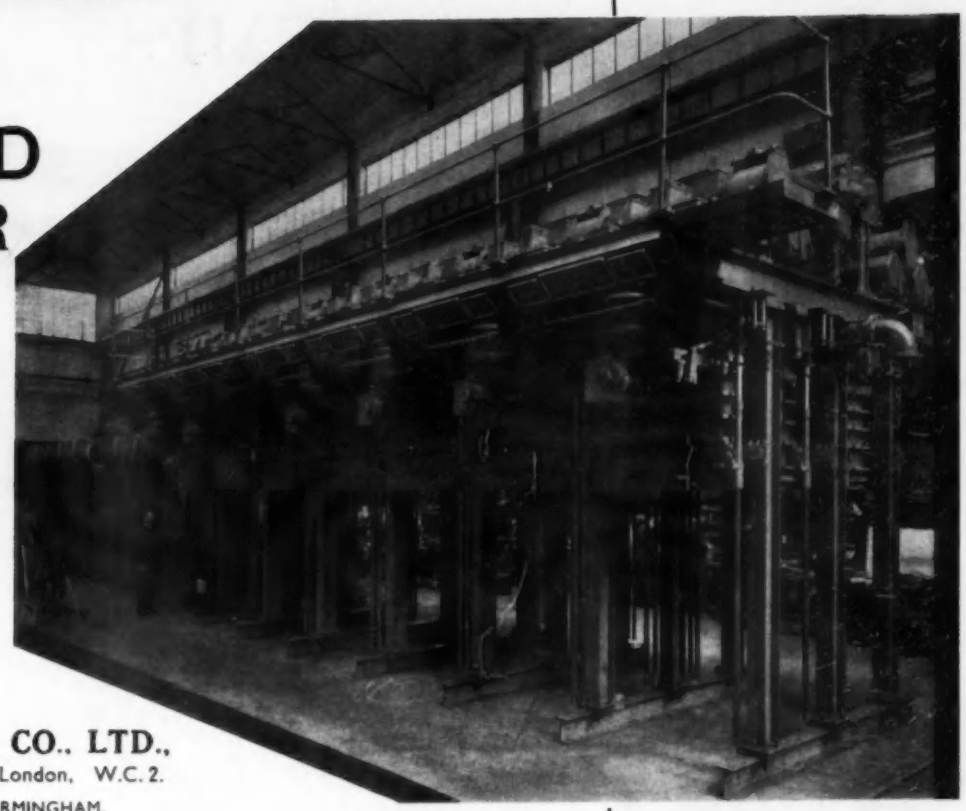
Full particulars and Colour Chart from
COLARDO PRODUCTS LD.
VASTERN ROAD, READING.

COLARDO FIRE-PROOF PAINTS are the only paints awarded Certificate, Temporary Protection Class A by the National Fire Brigades' Association.
for all wooden buildings.

EVERYTHING The G.E.C. your guarantee ELECTRICAL

G.E.C.
METAL CLAD SWITCHGEAR

G.E.C. Metal Clad Switchgear is manufactured at the G.E.C. High Tension Works at Witton, an extensive section of which is laid out specifically for the assembly of this class of apparatus.

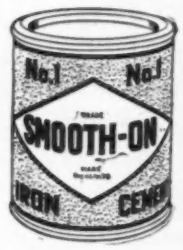


The view shows 750,000 kVA, 33,000 volt metal clad switchgear of the drop down pattern for installation in a large company power house. Here shown during erection at Witton Works.

Manufacturers:
THE GENERAL ELECTRIC CO., LTD.,
Head Office: Magnet House, Kingsway, London, W.C. 2.
SWITCHGEAR WORKS, WITTON, BIRMINGHAM.
Branches throughout Great Britain and in all the principal markets of the world.

SMOOTH-ON No. 1

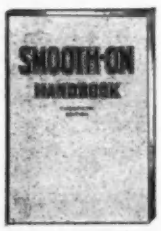
should be used for repairing breaks in castings, making tight joints and seams, stopping leaks in boilers, pipe lines, pressure containers, etc., and for countless home and automobile repairs. Becomes hard as iron when metallized. May be applied on iron, brass, steel, copper, lead, aluminium, etc.; either alone or as a filling compound under a plate, and will withstand fire, water, steam, oil and very high pressures.



Smooth-On No. 1 makes a surprisingly simple and effective repair or joint where other methods would be difficult. Be the first to suggest it and get the credit for the saving.

The SMOOTH-ON Handbook describes and explains proper application for full benefits.

This book contains full directions for using Smooth-On and has many diagrams and pictures to show what Smooth-On can do and has done.



Every factory manager, power plant engineer and repair man should have this information for quick reference. Ask us for a free copy.

Smooth-On No. 1 is carried in stock by leading dealers and supply houses everywhere.

Buy in 1 or 5-lb. can, or 25 or 100-lb. keg.

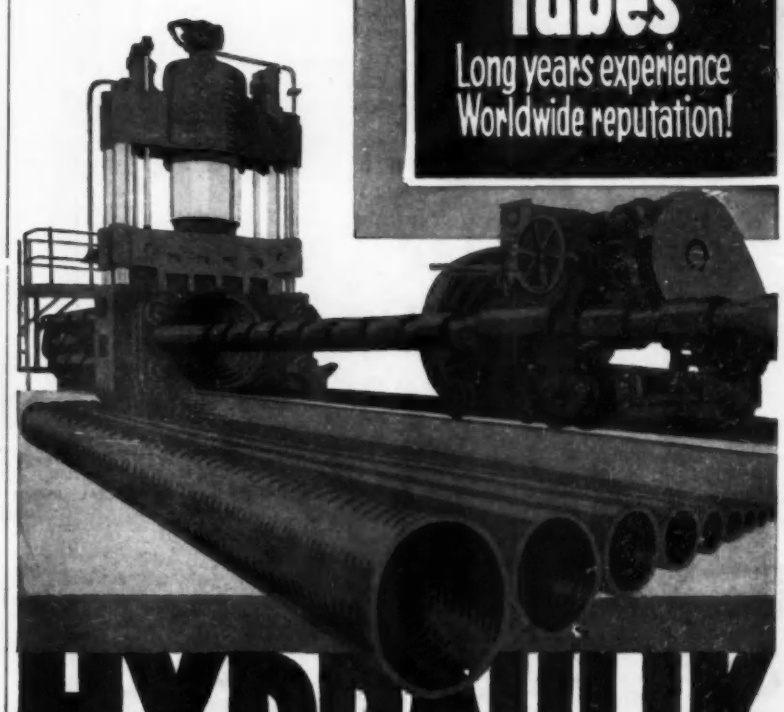
Distributed by Walter P. Notcutt, Ltd.,
Notcutt House, Southwark Bridge Road, London, S.E. 1.
Made by Smooth-On Mfg. Co., Jersey City, N.J., U.S.A.

Do it with SMOOTH-ON

LINOLEUM MACHINERY

CALENDERS, MIXERS,
CORK MILLS, SCRAP, OXIDISING,
PRINTING (FLAT & ROTARY),
AND ALL OTHER MACHINES.
LINOLEUM AND FLOORCLOTH FACTORIES COMPLETELY EQUIPPED.
THE MELVILLE-BRODIE ENGINEERING Co.
KIRKCALDY, SCOTLAND.

Hydraulic machinery for manufacturing
Seamless Tubes
Long years experience
Worldwide reputation!



HYDRAULIK
G·M· DUISBURG ·B·H

A. C. POTTER & CO.

MAKERS OF

STEAM ENGINES **OIL ENGINES**

PUMPS

RECIPROCATING CENTRIFUGAL

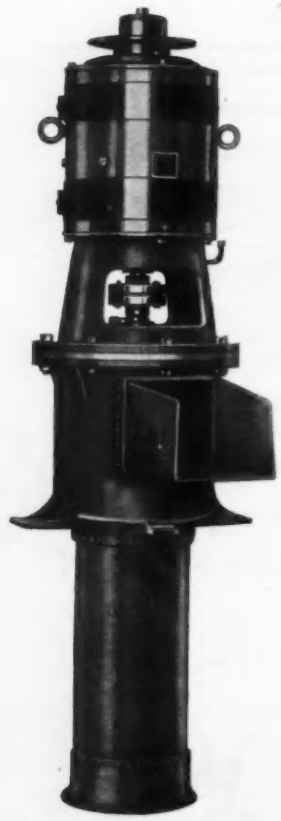
POTTER
STEAM ENGINE
FOR OPERATING DEEP WELL
AND BOREHOLE PUMPS.

MADE TO RUN
WITHOUT OIL.

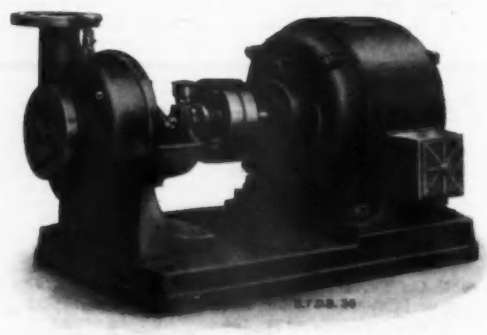
EXHAUST STEAM BEING USED DIRECT IN ANY DELICATE PROCESS WORK WITHOUT AUXILIARY PLANT.

RELIABILITY PROVED BY OVER 25 YEARS' DAY AND NIGHT RUNNING.

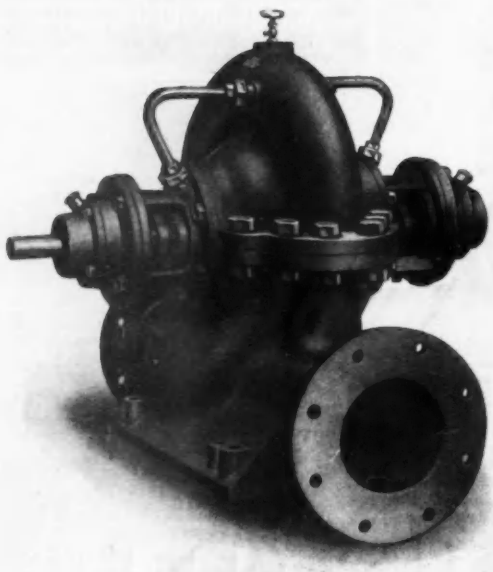
POTTER
COLD START HEAVY OIL ENGINE ON TEST IN OUR WORKS



MOTOR DRIVEN 12" CENTRIFUGAL CIRCULATING PUMP, MADE IN SPECIAL METALS FOR USE IN TANNERIES.



MOTOR-DRIVEN CENTRIFUGAL PUMP



DOUBLE ENTRY CENTRIFUGAL PUMP

COMBINED CENTRIFUGAL PUMP AND MOTOR

GRANTHAM

INDEX TO ADVERTISEMENTS.

Cover.

Ransomes & Rapier, Ltd .. 1
Lysaght, John, Ltd ii
Ransome & Marles Bearing Co., Ltd ii
Walker, J., & Co., Ltd ii
Boyles, Ltd iii
Premier Gas Engine Co., Ltd iii
De Bergue & Co., Ltd iii
English Steel Corpn. Ltd .. iv

Abbott & Co., Ltd 33
Alton & Co., Ltd 43
Alexander, H., & Co., Ltd .. 33
Allen, W. H., Sons & Co., Ltd 33
Angus, G., & Co., Ltd 5
Arkinstall Bros. Ltd 33
Arrol, Sir W., & Co., Ltd .. 36
Ash, J., & Son, Ltd 4
Ashmore, Benson, Pease & Co., Ltd. 56
Ashworth & Parker 33
Associated British Machine Tool Makers, Ltd 15
Aster Ltd. 30
Auld, D., & Sons, Ltd 51
Bagshawe & Co., Ltd 36
Barclay, A., Sons & Co., Ltd 33
Barns, W., & Son 52
Baxter, W. H., Ltd. 62
Beardmore, W., & Co. Ltd.. 55
Beckett, A., & Sons, Ltd .. 55
Bedford Engineering Co. .. 22
Beebee, A. 55
Bennie, J., & Sons, Ltd .. 30
Berry, H., & Co., Ltd 29
Boulton & Paul, Ltd 58
Bowes Scott & Western, Ltd 51
Boyle, R., & Son 33
Brackett, F. W., & Co., Ltd 55
Braby, F., & Co., Ltd 3

Brutta Patent Lifter Co., Ltd 55
Bridge, D., & Co., Ltd 10
Brit. Dardelet Threadlock Ltd 53
British Institute of Engineering Technology 4
British Ropeway Eng. Co. .. 50
British-Russian Gazette & Trade Outlook 49
Brit. Soot Blower Co., Ltd .. 51
British Steam Specialties, Ltd 26
Bringe, W., & Sons, Ltd .. 37
Broadbent, R., & Son, Ltd 4
Broom & Wade, Ltd 47
Brotherhood, P., Ltd 32
Brown Bayley's Steel Works 54
Brown, D., & Sons, Ltd .. 11
Brownlie & Murray, Ltd .. 53
Bruce Peebles & Co., Ltd .. 56
Budenberg Gauge Co., Ltd.. 46
Bull's Metal & Melloid Co., Ltd 33
Butcher, H., & Co. 52
Carobronze Ltd 3
Carron Company 50
Cellactite & British Uralite Ltd 34
Chemical & Insulating Co 16
Chilled Castings, Ltd 51
Clarke, Chapman & Co., Ltd 40
Clarke's Crank & Forge Co., Ltd 4
Clarkson Thimble Tube Boiler Co., Ltd 31
Clarkson 4
Clayton, Son & Co., Ltd .. 54
Cleveland Bridge & Eng. Co. 56
Clifton & Baird, Ltd 55
Clyde Structural Iron Co., Ltd 56
Cockburns Limited 56
Cohen, G., Sons & Co., Ltd 4–52
Coil Clutch Co., Ltd 56
Colardo Products Ltd 48
Coltman, W. W., & Co., Ltd 49

Conveyor & Elevator Co. .. 52
Copes Regulators, Ltd 35
Coventry Victor Motor Co. 50
Cowans, Sheldon & Co., Ltd 51
Crane-Bennett, Ltd 56
Crofts (Engineers), Ltd .. 14
Cull, W. B., & Son 7
Dampney, J., & Co. 24
Darlington Forge, Ltd.. .. 56
Davies & Metcalfe, Ltd .. 56
Davies, W. J., & Sons, Ltd.. 46
Davis & Primrose, Ltd 61
Davy Bros., Ltd 36
Dawson & Downie, Ltd .. 6
Deane, Smith & Grace, Ltd .. 21
Delco-Remy & Hyatt, Ltd .. 9
Demag, Duisburg 26
Donkin (Bryan) Co., Ltd .. 58
Drummond Bros., Ltd 56
East Ferry-Road Engin'g Co 47
Easton & Johnson, Ltd .. 46
Ellison, W. T., & Co., Ltd .. 56
English Electric Co., Ltd .. 23
Evans, J., & Sons, Ltd 48
Farrar Boilerworks Ltd .. 56
Fawcett, Preston & Co., Ltd 54
Ferodo, Limited 41
Firth, Thos., & John Brown, Ltd. 17–32
Fleming & Ferguson, Ltd .. 7
Fleming, Birkby & Goodall 4
Fraser & Chalmers Engineering Works 59
Fraser, D., Sons, & Ltd .. 55
Fuller, Horsey, Sons & Cassell 62
Galloways Ltd. 33
Gandys Ltd 54
Garner, Telford & Hardman 4
General Electric Co., Ltd .. 59
Gibbons, Bros., Ltd 33
Gilkes (Gilbert) & Gordon, Ltd 51
Gimson & Co. (Leicester), Ltd 53
Glasgow Railway Eng. Co .. 33

Glenfield & Kennedy, Ltd .. 18
Glenifer Engines, Ltd 33
Gloucester Foundry, Ltd .. 33
Goodall, Clayton & Co., Ltd 50
Gordon, J., & Co., Ltd 4
Grafton & Co 55
Grantham Boiler & Crank Co 62
Grieve, J., & Co 53
Griffin, C., & Co., Ltd 62
Guest & Chrimes, Ltd 52
Gutehoffnungshutte Dusseldorf 42
Gwynnes Pumps Ltd 24
Hall, R. J., & Co., Ltd 6
Hall, J. & E., Ltd 9
Hamworthy Engineering Co 33
Harpers Limited 62
Harris & Mills 33
Harvey, G. & A., Ltd 36
Haslam & Newton Ltd 51
Hathorn Davey & Co., Ltd .. 39
Hawthorn, Leslie & Co 36–62
Head, Wrightson & Co 62
Heathman, J. H. 53
Henderson, J. M., & Co .. 61
Herbert, A., Ltd 3–13
Hick, Hargreaves & Co., Ltd 56
Hill & Smith, Ltd 35
Hodge, Samuel & Sons, Ltd.. 9
Holden & Brooke, Ltd 33
Holland, B., & Co.. 50
Howell & Co., Sheffield .. 44
Hudson, R., Ltd 27
Hudson, J. & Co., Successors 61
Hudswell, Clarke & Co., Ltd 35
Hunt, Herbert, & Sons .. 44
Hurst, Nelson & Co., Ltd 31–33
Hydraulic Eng'g Co., Ltd .. 18
Hydraulik G.m.b.H. 59
Igranic Electric Co., Ltd .. 8
Independent Pneumatic Tool Co 22

Inco Forge Co., Ltd 62
Ingersoll-Rand Co., Ltd .. 31
Ings Foundry Co., Ltd 62
Isler, C., & Co., Ltd 39
Jackman, J. W., & Co., Ltd 54
Jenkins Bros., Ltd. 31
Jenkins, R., & Co., Ltd .. 38
Johnson, W., & Sons 56
Kearns, H. W., & Co., Ltd.. 50
Kirk, Price & Co 3–62
Kitchen & Wade 54
Kortine Bros. (1917), Ltd .. 52
Lacy-Hulbert & Co., Ltd .. 60
Lake & Elliot, Ltd 62
Lanz Bridge Ltd 35
Lancaster and Tonge, Ltd .. 55
Lea Recorder Co., Ltd. .. 50
Ledward & Beckett, Ltd .. 35
Leeds Engineering & Hydraulic Co., Ltd., The 31
Liverpool Refrigeration Co. 4
London & Lancashire Insurance Co., Ltd 22
Long, K., & Co 55
Maclellan, P. & W., Ltd .. 33
Marsden, H. R., Ltd 32
Marshall, Fleming & Co., Ltd 25
Marshall, Sons & Co., Ltd .. 20
Massey, B. & S., Ltd 47
Mechans Limited 44
Meldrums, Ltd 60
Melville-Brodie Eng. Co .. 59
Merryweather & Sons, Ltd.. 7
Metallic Manufacturing Co 20
Metropolitan-Vickers Electrical Co., Ltd 56
Michell Bearings, Ltd 50
Midland Flexible Metallic Tubing Co., Ltd 44
Mitchell Conveyor & Transporter Co., Ltd 54
Mirrlees Watson Co., Ltd .. 42

Moss Gear Co., Ltd 48
Motherwell Bridge & Engineering Co., Ltd. 37
Mumford, A. G., Ltd 48
Negretti & Zambra 6
Neill, J., & Co., Ltd 58
Newell, E., & Co., Ltd.. .. 43
Newton, Chambers & Co., Ltd 40
Noble & Lund, Ltd 45
North British Loco. Co., Ltd 41
Oakey, J., & Sons, Ltd. .. 26
Owens Boiler Circulator (1930), Ltd 61
Parsons Oil Engine Co., Ltd 31
Paterson Engineer'g Co., Ltd 50
Pearson & Knowles Engineering Co., Ltd 58
Peckett & Sons, Ltd 36
Peebles (Bruce) and Co., Ltd 56
Pegg, S., & Son 52
Perrins Ltd 28
Petters Ltd 54
Phillips, J. W. & C. J., Ltd.. 54
Pickering, R. Y., & Co., Ltd 33
Plenty & Son, Ltd 7
Plenty-Still Oil Engine, Ltd 56
Pollock, Macnab & Highgate 50
Positive Lock Washer Co .. 46
Power Plant Co., Ltd 2
Potter, A. C., & Co 60
Pressure Piling Co., Ltd .. 61
Pulsometer Engineering Co 32
Pumping Equipment, Ltd .. 30
Raleigh Cycle Co., Ltd. .. 8
Rapid Magnetting Machine Co., Ltd 55
Ratsey 29
Redler Patents 31
Reid Gear Co., Ltd 50
Reveirs, G., Ltd 35
Reyrolle & Co., Ltd 46
Richards, G., & Co., Ltd .. 15

Ritchie-Atlas Eng. Co. .. 55
Robinson, T., & Son, Ltd .. 14
Rose, Chas., Ltd 26
Rosser & Russell, Ltd 62
Russell, Geo. & Co., Ltd .. 33
Russell, S., & Sons 61
Ruston-Bucyrus, Ltd 57
Ruston & Hornsby Ltd 9
Scott, D., & Co 61
Scottish Tube Co., Ltd 13
Scriven & Co., (Leeds), Ltd 55
Sentinel Waggon Works, Ltd 10
Side Groove Steel Filing Co 4
Skodaworks, Prague 57
Smith, J. (Keighley), Ltd .. 35
Smith, T., & Sons, Rodley .. 28
Smooth-On Mfg. Co 59
Smulders, A. F. 61
Spencer-Bonecourt, Ltd .. 4
Spencer-Hopwood, Ltd 52
Spencer, John, Ltd 56
Stanford Piston Ring Co., Ltd 52
Steam Plant Accessories, Ltd 33
Steel Company of Scotland 53
Steele & Cowlishaw 6
Sterling Foundry Specialties, Ltd.. 55
Stevens, A. & F., Ltd 52
Stewart & Lloyds Ltd 2
Stewarts & Lloyds Ltd 12
Stirk, J., & Sons, Ltd 55
Stone, J. B., & Co., Ltd .. 55
Stothert & Pitt, Ltd 49
Stott, S. S., & Co. 62
Sunden, T., Ltd 56
Superheater Co., Ltd 2
Swansea Superheaters, Ltd 33
Taylor & Challen, Ltd 62
Taylor & Hubbard 51
Taylor, Taylor, Hobson 35
Technological Institute of Great Britain 4

Tennent, R. E., Ltd 55
Thomas & Bishop, Ltd 62
Thompson, J. (Wolverhamp'n) Ltd 6
Thornton, A. G., Ltd 53
Thornycroft, J. I., & Co., Ltd 58
Thor Pneumatic & Electric Tool Co., Ltd 22
Timbrell & Wright 62
Trier Brothers, Ltd 51
Turbine Gears Ltd. 55
Turner, G. R., Ltd. 35
Underfeed Stoker Co., Ltd.. 34
"Unit" Superheater & Pipe Co., Ltd 46
Urquhart Lindsay & Robertson Orchar, Ltd 50
U.S. Metallic Packing Co .. 35
Valor Co., Ltd 47
Variable Speed Gear, Ltd .. 21
Vaughan Crane Co., Ltd .. 56
Wallsend Slipway & Engineering Co., Ltd 19
Wallwin Company, Ltd .. 26
Wallwork, H., & Co., Ltd .. 4
Ward, H. W. & Co., Ltd .. 15
Ward, T. W., Ltd 62
Warrgood-Otis, Ltd 35
Wellhead, Bibby Co., Ltd .. 50
Wells, A. C., & Co., Ltd .. 23
West's Gas Improvement Co., Ltd 10
Whessoe Foundry & Engineering Co., Ltd 3
Whitecross Co., Ltd 50
Whitehead, J., & Co., Ltd .. 7
White, R., & Sons 53
Wiley, J., & Sons., Ltd. .. 49
Willcox, W. H., & Co., Ltd.. 7
Wootton Bros., Ltd 55
Wright, A., & Co., Ltd.. .. 56
Wright, Anderson & Co., Ltd 30

COAL CONSUMPTION TEST.

On 3 Galloway Boilers 22ft. × 6ft. 6in. **with** and **without** OWENS BOILER CIRCULATORS over a period of **six months** with the same **class of coal under the same working conditions.**

SIX MONTHS WORKING WITHOUT CIRCULATORS.

Received	Tons	Cwts.		Tons	Cwts.		Tons	Cwts.
October, 1929	100	8	less	12	0	Stock =	88	8
November ,,	182	1	,,	40	0	,, =	142	1
December ,,	174	10	,,	35	0	,, =	139	10
January, 1930	180	1	,,	32	0	,, =	148	1
February ,,	124	9	,,	20	0	,, =	104	9
March ,,	161	19	,,	25	0	,, =	136	19
							759	8

SIX MONTHS WORKING WITH CIRCULATORS.

Received	Tons	Cwts.		Tons	Cwts.		Tons	Cwts.
October, 1930	114	12	less	31	0	Stock =	83	12
November ,,	129	17	,,	20	0	,, =	109	17
December ,,	176	4	,,	47	0	,, =	129	4
January, 1931	170	6	,,	40	0	,, =	130	6
February ,,	135	4	,,	20	0	,, =	115	4
March ,,	175	12	,,	23	0	,, =	152	12
							720	15

Coal saved on the corresponding six months .... Tons 38 Cwts. 13 = **£73 8 6**

OWENS BOILER CIRCULATOR (1930) LTD.

Telegrams: "OWBOCIRC, SOWEST, LONDON." **57, Victoria Street, Westminster, S.W. 1.** Telephone: VICTORIA 5459.

WERF GUSTO,
Firma A. F. Smulders,
SCHIEDAM, HOLLAND.
Specialities—
DREDGING PLANT, FLOATING CRANES, AND COALING VESSELS.
See our page Advertisement in future issues.

CHILLED CASTINGS, LTD., 27, MINCING LANE, LONDON, E.C.3.
CHILLED AND GRAIN ROLLS **"GRIFFIN"** for all purposes

CRANES - ALL TYPES HANDLING MACHINERY
JOHN M. HENDERSON & Co. Ltd.
KING'S WORKS ABERDEEN

S. RUSSELL & SONS.
METAL SAWING MACHINES.
HIGH SPEED SAW BLADES.
RENEWALS for "HILL'S SAWS."
See large advertisement page 53, June 5th.
LEICESTER.

PILING without Vibration!

NO DRIVING, therefore no vibration. NO CONCUSSION. NO SMOKE. Piles of any length can be sunk inside buildings. Minimum of 6ft. head room. 2ft. 6in. width.

The Pressure Concrete Piles can be employed under the most difficult conditions conceivable; they comply with the most exacting demands and render possible constructions hitherto impossible.

Please ask for Booklet "E."

THE **PRESSURE PILING CO. LTD.**
119, VICTORIA STREET, LONDON, S.W. 1
'Phone: Victoria 4366 (2 lines). Wire: "Pressurpile, Sowest, London."

COMPRESSED GASES.
VALVES
FOR
Oxygen, Hydrogen and Coal Gas Bottles
Sulphurous Acid Bottles — Carbonic Acid Bottles
Ammonia Bottles — Nitrous Oxide Bottles
Chlorine Bottles — Refrigerating Plant
D. SCOTT & Co., Ltd.
155, BROOMLOAN ROAD.
Govan, GLASGOW, S.W.

STEAM HAMMERS

FOR SMITHS' SHOPS AND FORGES.
Shipbuilders' and Boilermakers' Machine Tools.
Sole Makers of R. E. DAVIS'
PATENT BEVELLING MACHINES for SHIPS' FRAMES
DAVIS & PRIMROSE, LD., JUNCTION RD.
LEITH, EDINBURGH.

JOHN HUDSON AND CO.'S SUCCESSORS
72, Cannon Street, London, E.C.

AUCTIONS

ESTABLISHED IN BILLITER SQUARE IN 1807.

FULLER, HORSEY
SONS AND CASSELL,

11, BILLITER SQUARE,
FENCHURCH STREET, E.C. 3.

MECHANICAL AUCTIONEERS, SURVEYORS AND VALUERS

OF

MILLS AND MANUFACTORIES, ENGINEERING WORKS, &c.

BUSINESSES and PREMISES (For Sale, etc.),

N.W. LONDON.
6 miles from Marble Arch, within 3 mins. Underground Station.

A MODERN GROUND FLOOR FACTORY, with frontage to main road. Covered floor area about 10,000 sq. ft., with ample land for extension. All services available, including central heating. Important position, with good advertising facilities.

FREEHOLD to be SOLD at an exceptionally attractive figure.—Apply,
CHAMBERLAIN AND WILLOWS,
Factory Agents,
23, Moorgate, E.C. 2. Metropolitan 5441.
7146 L

FACTORIES, SOUTHALL,
TO BE LET OR SOLD.

ALONGSIDE G.W. RLY. SIDINGS & CANAL.
450,000 Sq. Ft. of FLOOR AREA AVAILABLE.

Sole Agents:
LEOPOLD FARMER & SONS,
Factory Specialists and Surveyors,
46, Gresham St., E.C. 2. 7080 L

MODERN FACTORIES
TO BE LET AT LETCHWORTH.

60 Prosperous Concerns already located there. Healthy—Accessible—Cheap Electricity—Ample Labour. Enquire for particulars of
HENRY BUTCHER and CO,
Factory Specialists,
63/64, CHANCERY LANE, W.C.2.

FOR SALE
Continued from page 4

600

A few selections from our Large Stocks

WARNER and SWASEY 3 A Turret.
HERBERT No. 9 Turret.
HERBERT No. 4 Capstan.
STIRK 20ft. by 7ft. by 6ft. Planer, 4 heads, Motor driven.
ARCHDALE 5ft. Radial Drilling and Tapping Machine.
AMERICAN 6ft. Universal Radial Drilling and Tapping Machine.
WEBSTER and BENNETT 18in. Duplex Borer.
STIRK 42in. Vertical Boring Mill.
BULLARD 36in. and 24in. New Era Boring Mills.
LODGE and SHIPLEY 7in. by 6ft. Tool-room Lathe.
DEAN, SMITH and GRACE 24in. Surfacing and Boring Lathe.
HERBERT Precision Screw Cutting Lathe.
BROWN and SHARPE 4B Plain Miller.
CINCINNATI No. 4 Plain Miller.
MILWAUKEE No. 1½ B Plain Miller.
STEPTOE 24in. Shaper.
SELSON 18in. Shaper.
BARBER COLMAN No. 3 Hobber.
FELLOWS No. 7 High-speed Gear Shapers.
GLEASON 11in. Bevel Gear Generator.
BROWN and SHARPE No. 13 Gear Cutter.
CHURCHILL 16in. by 84in. Plain Grinder.
NORTON 10in. by 50in. Plain Grinder.
LANDIS 10in. by 24in. Plain Grinder.
BROWN and SHARPE Nos. 1, 2 and 3 Universal Grinders.
BLANCHARD No. 16 Rotary Surface Grinder.
HEALD 60 and 65 Internal Grinders.
CHURCHILL No. 1 Cylinder Grinder.
COCHRAN BLY Nos. 5 and 6 Circular Saws.
FITCHBURG 4in. by 60in. Lo Swing Lathe.
HERBERT 30in. Double Disc Grinder.
LAPOINTE Nos. 1, 2 and 3 Broachers.

GEO. COHEN, SONS AND CO.
LIMITED.
PARK ROYAL ROAD, NORTH ACTON, LONDON, N.W. 10.
Nearest Station, North Acton (Central London Rly.)

ONE Four-coupled SADDLE-TANK LOCOMOTIVE of our own make, outside cyls. 14in. dia., 20in. stroke, wheel base 5ft. 6in. Fitted with a new boiler complete with steel fire-box and tubes. Boiler passed for 160 lb. working pressure. Wheels re-tyred, overhauled and equal to new.
Full particulars, PECKETT and SONS, Ltd., Atlas Locomotive Works, Bristol. 6765 G

ONE GAS-FIRED NATURAL DRAUGHT Brayshaw ANNEALING FURNACE, size No. 10 R, with inside measurements of oven 9in. by 9in. by 12in., suitable for temperatures of 700 deg. C. £12 —Can be inspected at GILLETT and JOHNSTON, Ltd., 43, Whitehorse-road, Croydon. P1239 G

GRIFFIN

INTERNAL COMBUSTION ENGINE DESIGN AND PRACTICE.
By EDWARD BUTLER, M.I.Mech.E.
Second Edition, Thoroughly Revised. In Demy 8vo. Cloth. Pp. i-xvi + 273. With 230 Illustrations, including 6 Folding Plates. 21s.
"A work to be thoroughly recommended."—Motor Ship.

TRANSMISSION GEARS: Mechanical, Electrical and Hydraulic—for Land and Marine Purposes.
By EDWARD BUTLER, M.Inst.Mech.Engr., etc.
In Medium 8vo. Cloth. Pp. i-xii + 164. With 126 illustrations, including 9 Folding Plates. 8s. 6d.
" . . . useful information. The book is well Illustrated.—The Engineer.

THE DESIGN OF STRUCTURES.
By S. ANGLIN, C.E., Master of Engineering, Royal University of Ireland, Late Whitworth Scholar, etc.
Sixth Edition. In Large Crown 8vo. Cloth. Pp. i-xxiv + 511. With 255 Diagrams, also Examples and Tables. 10s.
"The best Text-book on the subject."—Mechanical World.

A PRACTICAL TREATISE ON BRIDGE CONSTRUCTION.
By T. CLAXON FIDLER, M.Inst.C.E., Prof. of Eng., University College, Dundee.
Fifth Edition. In Royal 8vo. Cloth. Pp. i-xxx + 456. With 239 Illustrations, including 15 Lithographic Plates. 30s.
"Sound, simple and full."—Engineer.

THE PRACTICAL DESIGN OF PLATE GIRDER BRIDGES.
By HAROLD HUGHES BIRD, Assoc.M.Inst. Civil Engrs., Assoc.M. Inst. Mech.E.
In Medium 8vo. Cloth. Pp. i-viii + 180. With 2 Plates and 144 Diagrams. 15s.
"This book is confined to plate girder bridges from the practical point of view . . . of great importance in bridge designing."—The Engineer.

Prices Net. *Postage Extra.*

42, DRURY LANE, LONDON, W.C. 2.

FOR SALE

NEW 60 H.P. DE LAVAL STEAM TURBINE, by Greenwood and Batley. Final speed 1500 r.p.m., 160 lb. pressure. Price, f.o.r. Nottingham, £35.—P. H. C., Ltd., King-street, Nottingham. 7093 G

ROLL GRINDING MACHINE, by Masson Scott, M.S. type, two grinding wheels, 12in. dia. by 1 5/8in. face, adjustable by hand wheels, 7ft. bed, screws roll carriages, solid steel former (for cambering), 9in. dia. by 7ft. long, with countershaft.
PRICE £150.
ROTARY SURFACE GRINDER, by Walker Grinding Co., W.S.A. magnetic chuck 12in. dia.
PRICE £70.
"Bath" UNIVERSAL TOOL GRINDER, No. 2, "T" slotted table 3ft. 6in. by 7in. wide for cylr. internal, surface and discount grinding.
PRICE £75.
JOHN CASHMORE, GREAT BRIDGE, STAFFS.

The Kilmarnock Engineering
COMPANY, LIMITED.
BRITANNIA ENGINEERING WORKS, KILMARNOCK.

The PLANT, STOCK, &c., used by the above well-known company in respect of their General Engineering Work, Plate and Angle Work, Light Railway (Tip Wagons, Points, Crossings), &c., are being OFFERED for SALE by Private Treaty, at exceptionally low prices.
All the Plant is in good condition, and has been in use until very recently, and inspection may be obtained on application to the WORKS SUPERINTENDENT at the above premises. 7158 G

THOS. W. WARD LTD.
IN STOCK AT SHEFFIELD.

Heller CIRCULAR COLD SAWING MACHINE, to cut rounds approx. 15½in. dia.
Heller CIRCULAR COLD SAWING MACHINE, to cut rounds approx. 13½in. dia.
Heller CIRCULAR COLD SAWING MACHINE, to cut rounds approx. 10in. dia.
Heller CIRCULAR COLD SAWING MACHINE, to cut rounds approx. 9in. dia.
1927 make "Atkinson Walker" STEAM RAIL TRACTOR, 4ft. 8½in. gauge, spring buffers, 230 lb. W.P.
LARGE SELECTION of Modern STEAM CARGO WINCHES (Clarke-Chapman), from 4½in. to 10in. dia. cylinders, brakes, clutches on squared shafts.
THREE LANCASHIRE BOILERS, 30ft. by 8ft., re-insure 150 lb. pressure.
PETROL-DRIVEN ROAD ROLLER, by Barford and Perkins, built 1925, 6 tons empty, 7½ tons with water ballast, tandem type.
ASK FOR "ALBION" MACHINERY CATALOGUE.
ALBION WORKS, SHEFFIELD. Ex.

5-TON Royce 3-MOTOR ELECTRIC TRAVELLING CRANE, 41ft. span, cage control; also RUNWAY JOISTS with Rails to suit.
30 cwt. Taylor and Hubbard LOCO. CRANE, 20ft. steel jib, standard gauge.
JAMES DIXON, Central Works, Burnley. 7100 G

10in. by 12in. Vertical Belt-driven Geared Three-throw RAM PUMP, by Pearns, capacity 27,180 galls. per hour to 300ft. head.
6in. by 8in. Belt-driven Geared Three-throw RAM PUMP, by Tangye.
Vertical Compound BOILER FEED PUMP, by Hall, cylinders 6½in. by 9in. by 6½in. dia., water end. 48in. Steam-driven HYDRO EXTRACTOR, suspended type.
16 N.H.P. LOCO. TYPE BOILER, by Robey, will re-insure for 100 lb. working pressure.
12ft. 6in. by 4ft. 6in. VERTICAL MULTITUBULAR BOILER, will re-insure for 100 lb. w.p.
COCHRAN BOILER, 8ft. 6in. by 3ft. 9in., insured at 100 lb. w.p., now working, available 31st March, 1931.
44-kW. 110-Volt D.C. Petrol-driven LIGHTING SET.
Slow-speed 70 H.P. ELECTRIC MOTOR, by Siemens, compound wound, 440 volts D.C., 350 r.p.m.
50 H.P. ELECTRIC MOTOR, by British Thomson-Houston, 500 volts D.C., crane rated.
STANLEY ENGINEERING CO., Bath. Telephone, 4294 (2 lines).

'PHONE 98 STAINES.
124-kW DIESEL GENERATING SET. Only worked a month. 215 volts D.C.
Weir Unused Admiralty Type FEED PUMP, 15½in. by 12in. by 24in.
120-kW STEAM GENERATING SET, 220 volts D.C.
150-kW STEAM GENERATING SET, 500 volts D.C.
40-kW Cold-starting CRUDE OIL GENERATING SET, 440/220 volts D.C.
VERTICAL THREE-THROW CARGO RAM PUMP, by Pearn, 11in. rams, 12in. stroke, 440 volts D.C.
80-kW Belt-driven DYNAMO, 220 volt D.C., 550 revs.
20 N.H.P. ROBEY COLONIAL LOCO. BOILER, 120 lbs. w.p.
50 H.P. and 70 H.P. PETTER VERTICAL CRUDE OIL ENGINES.
HARRY H. GARDAM and CO., Limited, Stalues. 7116 G

AUCTIONS

HENRY BUTCHER
& CO.
AUCTIONEERS, SURVEYORS & VALUERS
SPECIALISING IN THE SALE AND VALUATION OF
ENGINEERING AND ALLIED WORKS PLANT AND MACHINERY.
63 & 64, CHANCERY LANE, LONDON, W.C. 2.

Owing to Removal to Larger Premises.
SOUTHSEA AVENUE, WHIPPENDELL ROAD, WATFORD.
Henry Butcher and Co.
will offer for SALE by AUCTION, in Lots, on the PREMISES, on THURSDAY, 9th JULY, 1931, at Eleven o'clock a.m., the
LAUNDRY PLANT AND MACHINERY,
including "TULLIS" METAL-CASED WASHING MACHINES, HYDRO EXTRACTORS, by "American" and others; STEAM-JACKETED PANS, by Sugg and others; 10 H.P. "DAVEY-PAXMAN" 3ft. 6in. dia. by 12ft. LOCO. BOILER, 100 lb. W.P.; a 10 H.P. HORIZONTAL STEAM ENGINE, by Tullis; WATSON'S WATER SOFTENING PLANT; ELECTRIC MOTORS, 200-400 volts A.C., up to 50 H.P.; 2 CALORIFIERS, Laundry Hampers, Time Recorder, "Avery" Platform Weighing Machine, Shafting, Tanks, &c.
The CONTENTS of the ENGINEERS' SHOP, including S.S. and S.C. LATHES, "TAYLOR" HORIZONTAL MILLING MACHINE, SINGLE and TWO-SPINDLE DRILLING MACHINES, SHAPING MACHINE, POWER HACK SAWS, EMERY GRINDERS, Screwing Machine, "Roots" Blower, BOILER FEED PUMPS, by Weir, Mumford and Hayward-Tyler; LARGE QUANTITY of ASSTD. BELTING, SURFACE, AMMONIA and OTHER PUMPS, &c.
Catalogues (when ready) of Messrs. HENRY BUTCHER and CO., Plant and Machinery Auctioneers, 63 and 64, Chancery-lane, London, W.C. 2.

Railway Switches & Crossings,
TURNTABLES, WATER CRANES, TANKS, PIPES, BRIDGES, and ROOFS.
ISCA FOUNDRY CO., Ltd., Newport, Mon. London Offices, 53, Victoria-street, S.W.

Rosser and Russell, Ltd.,
Mechanical Engineers, Queen's Wharf, Hammersmith, W., UNDERTAKE SPECIAL MACHINE WORK of any description. Well-equipped shop, lathe work up to 10ft. diar. 'Phone: Hammersmith 31. 967

Steam Boilers, All Types and
Sizes, Vertical, Loco., Cornish, Launch, Field-tubes also Air Receivers, Feed-water Heaters, &c.—THE GRANTHAM BOILER & CRANK Co., Ltd., Grantham;

CONVEYOR & ELEVATOR Co. LTD.
ACCRINGTON.
See Advertisement last week.
PAGE 7.

HARPERS LIMITED.
See page 27, June 5th.

HEAD, WRIGHTSON
AND CO., LTD.
See Advert. June 19th, page 66.

FOR HIRE

ERECTORS' STEEL SECTIONAL DERRICKS (Various and Combinations), capacities single derrick to 6 tons at 80ft.—H. & T. DANKS (Netherton), LTD., Boilermakers, Steel Chimney Shafts and Riveted and Welded Plate Constructors, Netherton, Dudley. 7142 K

RICHD. D. BATCHELOR, ARTESIAN WELL ENGINEER (WATER SUPPLIES EXPERT). Largest Boring, Sinking and Pumping Plant. GRAVESEND CORPORATION TESTED TWO BORINGS to 14,000,000 GALLONS PER DAY (ONE GUARANTEED to 7,000,000).
73, Queen Victoria-street, E.C. 4, and Chatham.
'Phones: Central 4908; Chatham 2071.
Wires: Boreholes, London; Waterabed, Chatham.
ESTAB. OVER 150 YEARS.

AUCTIONS

FOR OVER 80 YEARS
WHEATLEY KIRK, PRICE & Co.
have specialised in
VALUATIONS,
PRIVATE TREATY
and
AUCTION SALES
of
ENGINEERING AND MANUFACTURING WORKS, PLANT AND EQUIPMENT,
and
THIS IS THEIR JUSTIFICATION FOR SOLICITING YOUR PATRONAGE AND AN ASSURANCE OF SATISFACTION.

Permit us to give you an estimate.

LONDON
46, Watling Street, E.C. 4.
MANCHESTER
16, Albert Square.

See also Page 2.

COLLIERY FOR SALE AS A GOING CONCERN.
By Order of the Receiver for the Debenture Holders.
TINGLEY COLLIERIES, LTD., WEST ARDSLEY, NEAR WAKEFIELD.
Wheatley Kirk, Price & Co.
have been instructed to offer for SALE by PUBLIC AUCTION,
THE WEST ARDSLEY COLLIERY,
with EQUIPMENT, and
TWO DWELLING-HOUSES,
IN ONE LOT, AS A GOING CONCERN.
Also
TWO FARMS AND 45 COTTAGES,
In FIVE SEPARATE LOTS,
At the QUEEN'S HOTEL, LEEDS,
On TUESDAY, 30th JUNE, 1931,
At Two o'clock p.m. prompt.
All subject to conditions of sale to be produced and read at the Auction.
The Colliery is situate at Tingley, about 5 miles from Wakefield and 4 miles from Leeds. The surface area, including the tipping ground, which is FREEHOLD, is approximately 48 acres, and extensive Sidings connect with the Bradford and Wakefield Branch of the L.N.E.R.
The Royalties under Lease extends to 1200 acres, and there are ample Coal Reserves.
The Pit is served by Steam Winding Engines and the Surface Screens and Washery, Underground Haulages, Pumps, and Coal Cutters are electrically driven, power being supplied by the Yorkshire Electric Power Co.
The Cottages and Farms are Freehold Properties.
The whole may be viewed on production of copy of particulars, which may be obtained (gratis), from the Receiver, James A. Couper, Esq., Messrs. Whitfield, Wilson, Couper and Co., Martin's Bank Chambers, Park-row, Leeds; the Solicitors, Messrs. Broomhead, Wightman and Reed, 14, George-street, Sheffield; or from the Auctioneers, WHEATLEY KIRK, PRICE and CO., 46, Watling street, London, E.C. 4. 7138 J

INCE FORGE Co., Ld., WIGAN
Hammered or Hydraulic Pressed
FORGINGS
in Iron or Steel, Black or Machined, to 20 Tons.

Millennium Malleable Castings
(Blackheart process).
Millennium Steel Castings.
BOTH MADE FROM THE ELECTRIC FURNACE.
LAKE & ELLIOT Ltd.
BRAINTREE, ENGLAND.

BAXTER'S KNAPPING-MOTION
STONE BREAKERS
ARE 50% MORE VALUE.
W. H. BAXTER Ld., LEEDS.

ELEVATORS and CONVEYORS.
SPROCKET WHEELS and CHAINS.
SEAMLESS & RIVETTED ELEVATOR BUCKETS
SEWAGE SCREENING & RAKING APPARATUS.
TRAVELLING DETRITUS ELEVATORS.
S. S. STOTT & Co., HASLINGDEN, Nr. Manchester.

TANK LOCOMOTIVES
SPECIFICATION and WORKMANSHIP EQUAL TO MAIN LINE LOCOMOTIVES.
R. and W. HAWTHORN, LESLIE and CO., Ltd.
NEWCASTLE-ON-TYNE.

TAYLOR AND CHALLEN PRESSES
FOR PRODUCTION OF SHEET METAL WORK, also makers of MINTING & CARTRIDGE PLANTS.
Foundry, Works & Showrooms BIRMINGHAM.
See large advert. page 55, June 19th.

Printed for the Proprietors by George Reveirs, Limited, at Greystoke-place, Fetter lane, London, and published weekly by Arthur Ronald Vaughan at The Engineer Office, 28, Essex-street, Strand, in the Parish of St. Clement Danes, in the County of Middlesex.

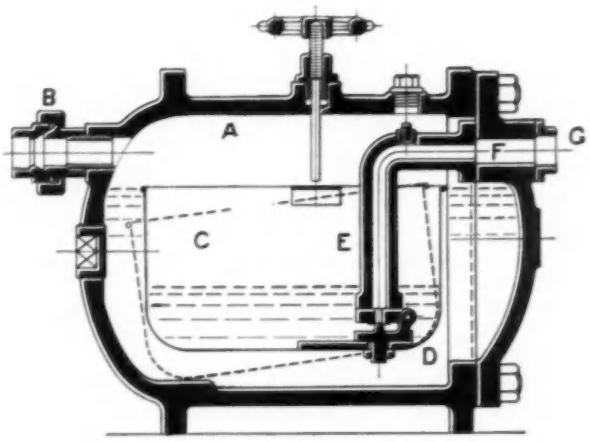
STEAM TRAPS

OF

PROVED RELIABILITY!

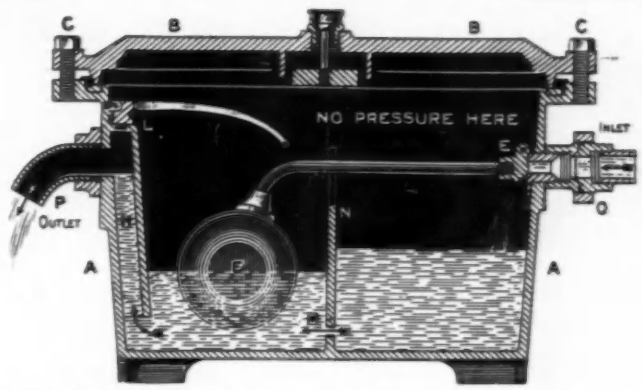
OVER **5000** SOLD IN **1930.**

MANY HUNDREDS OF REPEAT ORDERS.



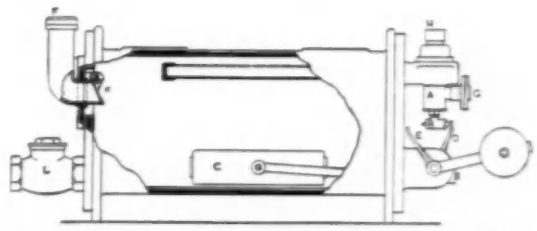
"SYPHONIA - RAPIDE"

A QUICK DISCHARGE HEAVY DUTY TRAP.



"SYPHONIA"—THE BEST "ALL-ROUND" TRAP.

EXTREMELY ECONOMICAL.



VACUUM & SUPERLIFTING TRAP.

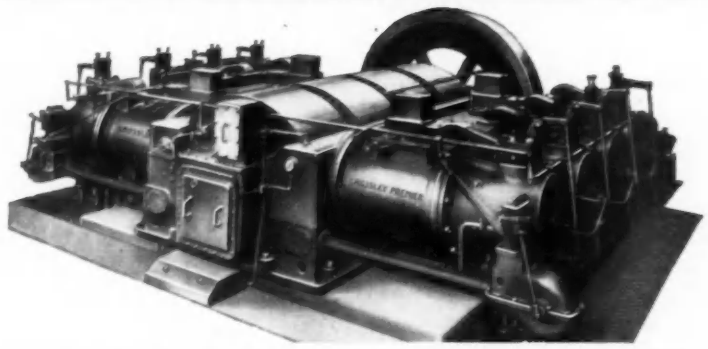
POSITIVE OPERATION BY LIVE STEAM.

Royles Limited

Irlam near Manchester

TELEGRAMS: "ELYOR" IRLAM.

TELEPHONES 133 and 134 IRLAM



The CROSSLEY-PREMIER VIS-a-VIS HEAVY-OIL ENGINE

Short stiff crankshaft, eliminating torsional vibration.

Rotating masses perfectly balanced.

Sweet and quiet running.

Reduced number of bearings with increased mechanical efficiency.

Low fuel & lubricating oil consumption.

ACCESSIBILITY.

Write for Catalogue to:

THE PREMIER GAS ENGINE Co LTD

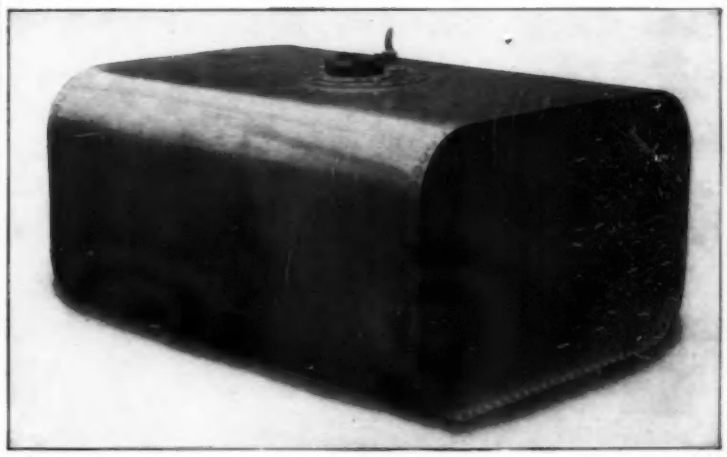
SANDIACRE · NR. NOTTINGHAM

P 49

WHAT STRIKES YOU

ABOUT THIS

RIVETED PETROL TANK?



Unless you are already familiar with our new riveting process, you will say, "There aren't enough rivets for petrol-tightness."

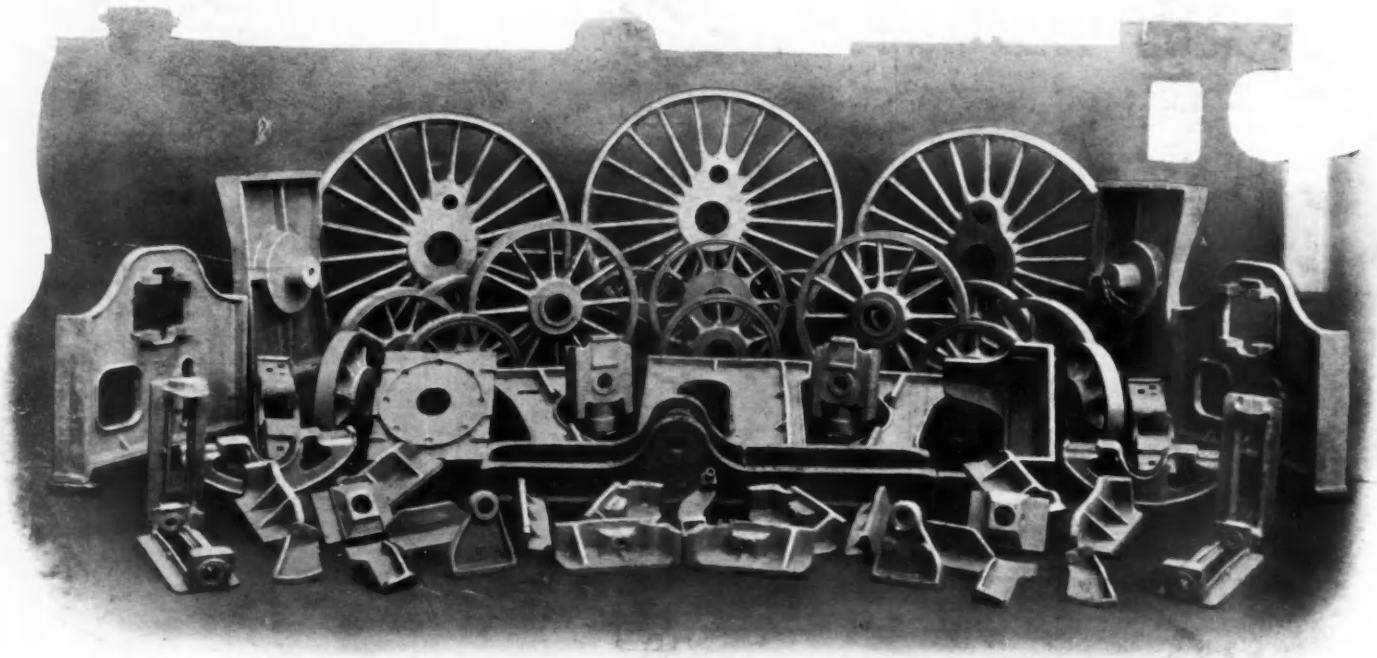
The tank illustrated is of Duralumin 20 gauge with a single line of our patent riveting 5/32" diameter at 5/8" pitch, without welding or soldering. It holds petrol under the most rigid pressure test.

The De Bergue Patent Countersunk Riveting Process is ideal for all metals including stainless steel up to 16 gauge.

This is the only riveting method by which the sheets are left dead flat and in perfect contact.

DE BERGUE & Co., Ld., MANCHESTER.

E·S·C Steel Castings for locomotives —



—and every other purpose for which steel castings of high quality can be used.

All enquiries to be addressed to:

Registered Office:

VICKERS WORKS,
SHEFFIELD.

Telegrams and Cablegrams: STEELCORPO, SHEFFIELD.
Telephone: SHEFFIELD 41071.

English Steel Corporation Ltd.

INCORPORATES THE STEEL INTERESTS OF VICKERS ARMSTRONGS (AT SHEFFIELD & OPENSHAW) AND CAMMELL LAIRD.

VISIT THE R.A.F. DISPLAY AT HENDON, JUNE 27th.

Printed for the Proprietors by GEORGE REVEIRS, LIMITED, at Greystoke Place, Fetter-lane, London, and published by ARTHUR RONALD VAUGHAN at THE ENGINEER Office, 28, Essex-street, London, W.C. 2.